Handbook
of
Metaphysics and Ontology
Volume 1
A–K

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Preface

The present project was conceived in Erlangen (Germany) in 1985 as a guide to the achievements of Brentano and his school. Our aim was to take account of the roots of Brentanian philosophy in classical realism and of the implications of the work of Brentano and his disciples for modern analytical metaphysics. It became clear, however, that an adequate realization of even this restricted aim would call for a much larger work than we had originally projected, and the enthusiastic reaction of those whom we invited to contribute led us to take on the task of preparing the present comprehensive *Handbook of Metaphysics and Ontology*.

This somewhat pleonastic title reflects the different histories of the terms 'metaphysics' and 'ontology' in the two cultures of Anglo-Saxon and Continental philosophy. On the one hand the term 'metaphysics' has pejorative overtones in continental philosophy as a result of the still pervasive influence of Kant's critique. On the other hand the term 'ontology' has an honourable history, above all in German philosophy from Goclenius and Wolff to Husserl and Ingarden, and both terms are employed ever more frequently in the writings of the more sophisticated analytic philosophers in ways which to some degree reflect an effort to build bridges to the classical metaphysical tradition.

Although more than 450 articles are here presented, the reader will find that certain topics otherwise deserving of separate treatment have been dealt with in the longer survey articles (for example on 'Analytic Philosophy', 'Aristotelianism', 'Metaphysics', 'Ontology', 'Part-Whole', etc.), which are included as a basis for general orientation. The reader will find also that cross-references have been kept to a minimum in the body of the work, their purpose being served instead by the extensive index.

It cannot be emphasized enough that this work is the creation of its more than 250 contributors, who spared no effort in meeting our exacting demands. We should like to thank especially Charles Lohr, Peter Simons, and Timothy Sprigge, whose services went above the call of normal academic duty. Our warmest thanks must however go to Hilla Hueber, who encouraged us to take seriously our initial ideas, and whose great energy, skill, accuracy, and patience in co-ordinating the work of all the contributors, editors, copy-editors, and production staff over a span of more than five years made it possible for us to bring these ideas to fruition. Finally, it is a special honour for us to be able to thank also Uwe Spaniol, Director of the Dresdner Bank in Munich, whose active support for *Philosophia* in recent years has been indispensable to the project.

The work grew out of a certain vision of philosophy as a discipline that is called upon to take account of the best results of logic and of the empirical sciences while at the same time nurturing a sound awareness of its own past achievements. We are gratified to see on all sides evidence of the fact that these two marks of philosophy are no longer regarded as incompatible.

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Introduction

The present work seeks to document the most important traditional and contemporary streams in the two overlapping fields of metaphysics and ontology. Both disciplines were, even just a few years ago, seen by many as of negligible contemporary interest. The editors, neither of whom had shared this general opinion, were none the less surprised to see how much valuable work had been achieved in these areas not only in the past but also in our own century. The intensity of contemporary work in metaphysics and ontology points indeed to a healthy renewal of these disciplines, the like of which has not been seen, perhaps, since the 13th century. In order to summarize what, from the editors' point of view, seem to be the most important trends underlying these contemporary developments, the present Introduction offers a brief and wilfully selective overview of the contents of this *Handbook*.

Aristotle

The founders of Western philosophy in ancient Greece initiated the development of metaphysical systems in a process culminating in the work of Plato, Aristotle, and the Stoics. It was especially Aristotle's metaphysics, called by him "first philosophy", that became paradigmatic for future research in the field, and this in at least seven respects:

– Aristotle analyses a wide range of metaphysical concepts: the categories (substance and nine kinds of accidents), the *praedicabilia* (genus, species, *proprium*, etc.), modal concepts, concepts of essence, existence, identity, privation, and four different kinds of cause.

– Aristotle uses four fundamental metaphysical relations, namely substance–accident, part–whole, cause–effect, and means–end, for the purposes of metaphysical analysis.

– Aristotle subscribes to a liberal methodological attitude, using different kinds of methods, such as definition, induction, and deduction, in his metaphysical works.

– In all his works Aristotle shows a fundamental empirical attitude which enabled him to introduce into science new empirical disciplines such as biology and non-celestial physics, in addition to the Platonic disciplines of metaphysics, geometry, and astronomy. This was possible first of all because Aristotle – in contradistinction to Plato – accepts as scientific not only ἐπιστήμη, i.e. necessary or certain knowledge, but also ἔνδοξα, i.e. probable or conjectural knowledge. But it was possible also because Aristotle embraced the idea that the sublunar reality in which we live manifests certain intrinsically intelligible structures our knowledge of which provides an *a priori* (pre-inductive) basis for science and philosophy.

– An important consequence of Aristotle's empirical approach is that his metaphysics is not a closed system like that of Plato, but is rather open to new insights and is intimately connected to all kinds of scientific developments.

– Aristotle's metaphysics is controlled further by his syllogistic, or more generally by logical considerations both formal and philosophical in nature. Thus from the beginning his metaphysics is a rational enterprise, bound up with the search for truth, and has nothing to do with myth or poetry.

– Yet even though Aristotle is the first to have developed a deductive system of logic, his metaphysics is not deductive but rather descriptive, defining its fundamental concepts in cumulative, empirical fashion.

Medieval and Post-Medieval Metaphysics

Aristotle's empirical and liberal methodological attitude was shared by all important medieval and post-medieval Aristotelians such as Avicenna, Averroes, Albert the Great, Thomas Aquinas, John Duns Scotus, William Ockham, Francisco Suárez, G. W. Leibniz, and Franz Brentano. The dominance of Aristotelianism is illustrated by the fact that, until the *Disputationes Metaphysicae* of Suárez in 1597, works on metaphysics standardly took the form of commentaries on writings in the Aristotelian corpus. Taking into account their empirical and rational attitude, it is not surprising that the scholastic Aristotelians – represented above all by the Dominicans, and later by the Jesuits – were the predecessors also of modern science.

A new topic in medieval metaphysics, foreshadowed in Plato's and Aristotle's theology and in that of the patristic philosophers, is the reflection on concepts of God, his perfections, his thinking, and his action. From this stem also reflections on possible worlds, on modal concepts such as the necessity and contingency of divine and human action, on absoluteness and dependence, and on the methodological differences between philosophy and theology.

The 17th Century

The 17th century brings three novelties. First, the name 'ontology' is introduced in 1613 by the German Protestant Scholastic Rudolphus Goclenius and from this time stands for *metaphysica generalis*, as contrasted with the *metaphysica specialis* of, for example, cosmology and natural theology. The second is that René Descartes, in some respects treading in the footsteps of Augustine, develops a metaphysics in which there is added to the description and analysis of the external world a rational treatment of the inner world, which is to say a metaphysics resting on the description of the mind, its acts, and their cognitive and non-cognitive contents. A third novelty consists in the development by Spinoza in his *Ethics* and by Leibniz in his *Monadology* of a new kind of deductive, systematic metaphysics. Spinoza was influenced in this respect by the renaissance of Euclidean geometry in the 16th century, Leibniz by his own pioneering inventions in the field of logical calculi. Descartes, Leibniz, and Spinoza were all in addition profoundly shaped by the scholastic tradition in which they had been trained, and therewith also by the Aristotelian metaphysics of substance and accident.

A central theme of metaphysics in the 17th century, though one which draws on earlier work above all by Scotus, is the problem of individuation, represented, for example, in the philosophies of Suárez and Leibniz. Not only the individuality of

substances is discussed but also, in the tradition of Aristotle and the medieval Scholastics, that of accidents such as actual properties, dispositions, processes, and situations. Leibniz introduces to philosophy the notion of an individual concept, a concept under which all the accidents of an individual fall, and therewith also aspects of the modern logical concept of a possible world.

The 18th Century

Kant criticized traditional metaphysical systems such as those of Leibniz and Christian Wolff which were in his mind dogmatic in character. In order to avoid dogmatic metaphysics, Kant developed instead a view according to which the world of experience is somehow formed or shaped by what he called the "transcendental subject", reality in itself remaining intrinsically unknowable.

German idealists such as J. G. Fichte, G. W. F. Hegel, and F. W. J. Schelling developed idealistic metaphysical systems not controlled or even disturbed by the existence of logic, and their work thus constitutes a deterioration in comparison with what had been achieved by earlier metaphysicians. Hegel replaced formal logic by dialectics, and the absence of logic in his philosophy, coupled with the lack of an analysis of the external world and the neglect of natural science and mathematics, yields as end-result a most peculiar absolutistic evolutionary idealism.

The Brentano School

The standards of rigour and descriptive adequacy of Scholasticism were re-established above all by Franz Brentano and his school. Brentano, a pupil of Adolf Trendelenburg, one of the few Aristotelians in the 19th century in Germany, created a philosophical system which was a synthesis of Aristotelianism, Cartesianism, and the empiricism of the British school. This system was modified in different and often highly original ways by his pupils, the most important of whom were Kazimierz Twardowski, Edmund Husserl, Carl Stumpf, Christian von Ehrenfels, Anton Marty, and Alexius Meinong.

In contradistinction to Hegel and his fellow idealists, the Brentano School was very successful in associating its philosophical work in fruitful ways with modern developments in the sciences, above all in psychology and linguistics. Brentano's pupils were responsible for founding not only new philosophical movements such as phenomenology, but also new programmes of scientific research such as the Gestalt theories of the Graz and Berlin Schools. Brentano's pupils contributed in important ways to modern logic, above all through Twardowski and his students in Poland. And they contributed also to ontology, for example through Meinong and the members of the Graz School, who established the so-called theory of objects. Husserl, following in some respects in Meinong's footsteps, founded in turn the discipline of formal ontology and was the first to analyse in formal manner the ontological concepts of dependence, part and whole. Husserl's work in this field was then continued in philosophy above all by Adolf Reinach and Roman Ingarden, and in its application to linguistic parts and wholes by Stanisław Leśniewski and others in Poland. Husserl's philosophical ideas on formal and material ontology gave

rise further to a new understanding of synthetic or material *a priori* truths. From the perspective of Husserl, Reinach, and Ingarden such truths are not, as for Kant, the products of a forming or shaping activity on the side of the subject. Rather, as for Aristotle, they represent intelligible structures on the side of the objects of experience, structures which are not invented but discovered, and which serve, again, as a pre-empirical basis for science and philosophy.

Early Analytic Metaphysics

The first analytic philosophers of our century, such as G. E. Moore, G. F. Stout, Bertrand Russell, and Ludwig Wittgenstein, did not, like many of their mid-century successors, suffer from an anti-metaphysical attitude. Moore's early ontological analyses focused on concepts and propositions. He understood concepts as non-subjective, eternal, and immutable objects of thought, as things that are real, but not part of nature. Russell distinguished more carefully between particulars and universals, developing in the wake of Gottlob Frege a logistic conception of mathematics which treats mathematical objects as logical constructions which are at the same time denizens of an eternal Platonic realm.

Frege, too, was something of an ontologist, though his peculiarly baroque brand of Platonism, recognizing the True and the False as supreme entities, has found few subsequent adherents. Wittgenstein's *Tractatus*, also at least in part an ontological work, seeks to combine the Fregean ontology of function and argument with an ontology of states of affairs or *Sachverhalte* which draws on the logical atomism outlined by Russell.

Lingering Kantianism, Vienna positivism, the philosophy of linguistic analysis, and above all W. V. O. Quine, thereafter served for a time to render unfashionable the ontological and metaphysical concerns which had for previous generations of philosophers formed the very centre of the discipline of philosophy. Quine's theory of ontological commitment is however far from eliminating the need for further ontological research. On the contrary, a theory of ontological commitment is one of the crucial meta-ontological presuppositions of every ontology. Other presuppositions are a theory of ontological reduction and an account of dependence, of part and whole, and of the other formal and material relations in which the entities admitted by an ontology may be conceived as standing.

Contemporary Metaphysics

Contemporary metaphysics is in many respects similar to Aristotelian metaphysics:

– In modern metaphysics, too, a wide range of concepts is subjected to analysis, concepts such as *event, process, action, situation, state of affairs, particular, nexus, world, set, guise*, and so on. In post-Meinongian ontological systems, moreover, the arsenal of entities treated is also in other respects much larger than it was in former times.

– As concerns the four fundamental ontological relations, it is above all mereological analysis that has seen the most impressive development, starting with

Stanisław Leśniewski and Nelson Goodman and culminating in the work of Peter Simons and others.

– Contemporary metaphysics, too, subscribes to a methodological liberalism, adapting its methods to the matters to be analysed.

– Contemporary metaphysics has a solid empirical foundation, enjoying close connections to natural sciences such as physics and biology, as well as to disciplines such as psychology and linguistics and to borderline areas such as artificial intelligence.

– Modern metaphysics, too, is an open system taking over from the sciences concepts like emergence, field, and space-time, and concepts of social wholes and parts, and subjecting these to new types of philosophical treatment.

– Different kinds of logic are fundamental for the development of metaphysical systems. The modern attitude leads to a logical pluralism, so that we have not only classical Frege-style logic, but also free logics, modal and paraconsistent logics, etc.

– Modern metaphysical systems are to an overwhelming degree deductive in nature and are in this sense closer to the systems of Spinoza and Leibniz than they are to those of the Aristotelian metaphysicians.

Of the two editors of this *Handbook* – who bear equal responsibility for all its parts and moments – one is an admirer of Leibniz and the 17th-century rationalists and thus finds himself strongly allied to certain modern deductive trends. The other feels more at home in the 13th or 14th centuries and is accordingly critical of the over-enthusiastic and often over-simplistic use of formal logical techniques in contemporary metaphysics. The editors are however equally convinced that it is precisely the tension between the deductive and descriptive approaches to the problems of metaphysics and ontology which will be responsible for the future creative advances in these fields. And they are convinced also that such advances can be furthered by an understanding of the history of metaphysics and ontology, an understanding – guided by the most sophisticated modern research and by the use of the most sophisticated modern techniques – of the sort this *Handbook* has been designed to facilitate.

A

Abelard. See: **Peter Abelard**

The Absolute

The expression 'the Absolute', as we will understand it here, was first introduced into philosophy by F. W. J. Schelling (1775–1854) and Hegel (1770–1831). It stands for the whole of things conceived as unitary, as spiritual, and as rationally intelligible as the finite things included in it are deemed not to be when considered apart from it. Often it is thought of as that whose existence is what is proved by an adequate ontological argument.

Just what expressions like 'the Absolute', 'the absolute Idea', and 'the Idea' mean in Hegel is controversial. Certainly he thought reality a dialectical progression from the simplest of all concepts (pure being) to the richest (the absolute idea) – these constituting the basic categories through which anything can be thought – then moving on through this to physical Nature itself (not merely the concept thereof) which, by a series of further dialectical steps, issues in Spirit or Mind (*Geist*). Spirit then ascends in human life by a series of stages from a primitive form of sensory understanding, in which effectively it merely contemplates pure being, to philosophical insight into the whole system leading from pure being to itself as the highest manifestation of that Absolute Idea which has been operative throughout the series and is in some sense identical with it as a whole. The dialectical series is not primarily chronological, though in human life chronology partially reflects its structure.

Somewhat similar ideas were held by other German philosophers, who constructed systems owing much to Kant but professing to break beyond the limits he had placed on human knowledge. Thus J. G. Fichte (1762–1814) interpreted human life and reality generally as an absolute ego which posits a non-ego for its moral development, and Schelling, Hegel's one-time associate, saw the Absolute as the identity of knower and known expressing itself both in mind and nature. For all such absolutists, the Absolute is that which unlike conditioned or finite things is intelligible in itself, and is without external conditions.

Among the most powerful proponents of the Absolute were the philosophers misleadingly called the Anglo-American Hegelians, especially F. H. Bradley and Josiah Royce.

For Bradley the Absolute is a harmonious timeless experiential whole in which its appearances (all finite things) exist in a harmonious unity which contrasts with what they seem to be individually to themselves and to each other. Finite things are appearances in a double sense. First, they are only specifiable by us in concepts which being internally contradictory cannot in literal truth apply to anything. Second, even as they really are they have no truly individual character which could be actualized out of their precise context in the whole, this being the main bar to their coherent conceptualization. We can dimly conceive this absolute experience on an analogy with the whole of our experience at any one moment, in which changing events are conceived or experienced in a single synthetic glance. It contrasts not only, and obviously, in the ungraspable contrast in the richness of its contents; but also in that our single experiences are, and feel themselves as, mere phases in an ongoing process, while it, though including the experience of the events of all time, has no temporal context and feels itself in an unchanging external moment. To prove the existence of such an absolute experience it is contended, first, that there is no genuine filling which reality could possibly have except sentient experience, and, second, that things which it is appropriate to think of as standing in relations to one another must help constitute, typically along with other things, a more comprehensive whole which is more of a genuine unit than they are. Since everything is related to everything else, they must all be included in a unitary whole which, as composed of experiences, must unify them in the one way in which experiences can be unified, namely as elements in a single experience. (The unreality of relations, for which Bradley argued, consists in the fact that relational thinking

treats terms of relations as having a distinctness incompatible with the togetherness it also requires of them.)

Royce argued somewhat similarly for a more personal Absolute nearer to a traditional conception of God. His most famous argument concerned the reference of thought to its objects. If it only picks them out by descriptions, then it can never be erroneous, for its objects, if it has any, must answer to its predicates; however, we *do* have erroneous beliefs so they must be picked out for us in some more basic way. This, claims Royce, can only be because we, together with our objects, are aspects of an absolute mind who deliberately intends objects in an initially inadequate way via our finite minds.

These arguments may falter in detail, but the essential point may stand: that things can only be related to each other if they are elements together in a whole which is more of a genuine unit than each is separately. (That does not mean that the more comprehensive is always a more genuine unit than the less, only that at some level there must be a more genuine comprehensive unit which related terms help to form; however, the main argument may require only that they must help to form a unit at least as genuine as themselves.) Bertrand Russell's arguments against this 'monistic' view of relations have been thought successful, but really only show that it requires a more careful statement than can be given here. Certainly for ordinary thought spatial relations between things are a matter of the larger spatial wholes they make up together, and time, it can be argued, must be conceived as some sort of embracing whole if there are to be temporal relations between events. If the idealist is right that space and time are merely objects of useful but finally incoherent conceptions derived from features of our perceptual fields, then they cannot be the true more comprehensive wholes in which all things (which for the idealist means all experiences) come together. So at least the present author has argued. Another of the Absolute's more recent defenders, J. N. Findlay (1903–87) argues further that every philosopher has his Absolute, something which needs no further explanation, but that only something like the Hegelian Absolute is an adequate one.

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TIMOTHY L. S. SPRIGGE

Absolute/Relative

A neat formal statement of this distinction would be immediately to hand if 'absolute/relative' denoted (as some have wrongly thought) the familiar monadic/relational distinction: despite its use to mark off things which are not, from things which are, essentially characterized by relation to something else, no simple treatment captures its full range of application in historical or contemporary discussions. An influential and distinctively Protagorean relativism, emerging most notably in the *Theaetetus*, serves as a useful departure. If we claim that truth is not an absolute notion but a relative one, we are not offering the trivial observation that something (a proposition, say) is true only in so far as it stands in relation to something else: our claim distinguishes itself from other theories of truth by entailing that, just as the wind is cold to him who feels cold and not to him who does not, so all truths are of the form 'I perceive that *P*' rather than '*P*'. Thus a Protagorean absolute/relative distinction has traditionally been regarded as dividing truths according to whether or not they are mind-dependent (or dividing concepts or predicates according to whether or not they truly apply independently of individual cognitive acts). Variants of this theme mark the distinction along slightly different lines, with 'social practices' or 'conceptual schemes' replacing 'cognitive acts'.

A concept *F* is plausibly said to be absolute, in a different sense, when 'absolutely *F*' is a proper but redundant predication – when *nothing could be more F*. Thus a concept *F* is absolute in so far as asserting that *x* is *F* amounts to claiming that some other concept *G*, which admits of degree, is not instantiated by *x*: 'flat' (along with 'empty', 'dry', and others) is absolute, because any-

thing to which 'flat' truly applies is absolutely flat, not bumpy to any degree. 'Bumpy' expresses, on this proposal, the corresponding relative concept (*G* above).

According to this way of setting off absolute from relative concepts (Unger 1984), very few things, if any, fall under absolute concepts. Perfectly bumpless surfaces are hard to come by. But then perhaps they are not, if what counts as a bump is relativized to the kind of surface being described (Dretske 1981): flat tables are one thing, flat polo fields another, and each may be perfectly bumpless relative to the standards appropriate to it. Hence it remains that if *x* is flat, nothing could be flatter, where now the standards for what counts as a bump (and so, for what counts as bumpless) are relative to a sortal under which *x* falls. Absolute concepts may be *relationally absolute* (Dretske's term) – absolute, exactly as given above, but relative to sortal-specific standards.

This latest strategy can be generalized to many other concepts, and to many other contexts of application: *x* is a large mouse, though not a large mammal, and nothing is large *simpliciter*. Two crucial points immediately arise. First, this familiar sort of context relativity does not entail that such predicates are many-ways ambiguous, for we are free to regard *indices of context* as parameters of their fixed semantic content, yielding different extensions under different contexts. But now the line between absolute and relative concepts becomes obscure. On the one hand, resemblance is not an absolute relation because *x* and *y* may at once be similar (relative to overall appearance) and dissimilar (relative to age, intelligence, and mannerisms); on the other hand, resemblance is an absolute relation, no longer of two terms but of three: *x*, *y*, and the respect of similarity.

Second, our reference just now to absolute relational concepts, and Dretske's talk of relationally absolute concepts (even if teasingly close to double-talk for 'relative' after all), recommended that we distinguish *relative* from *relational* as categories. This is particularly crucial for discussions of space and time, in which the absolute/relative distinction is often forced into double duty as an absolute/relational distinction. The latter distinction, but not the former, is at issue between Leibniz and the Newtonians: Newton regarded space as "absolute, . . . fixed and immovable" – as a substantival entity in which material bodies have locations, and by virtue of which locations bodies have the spatial properties they do have; Leibniz, denying in the correspondence with Samuel Clarke (1675–1729) that space exists as something logically prior to things in it, argued instead that space is no more than a system of mutual relations among coexisting bodies, much as a genealogical tree is no more than a complex of relations among members of a family.

Although 'absolute/relative' may characterize any number of distinctions in treatments of space and time (Horwich 1978), the most important relativity principles, featured in both Newtonian and Einsteinian theories of space and time, have little bearing on the absolute/relational controversy. A spatio-temporal property or relation is regarded by a theory as absolute if that property or relation is the same in any frame or kind of frame (invariance), and relative if it varies according to frame or kind of frame (covariance). Classical relativity thus says that elementary mechanical laws hold with respect to any arbitrary inertial frame, as guaranteed by the Galilean transformations, under which spatial and temporal separation are invariant. According to the Special Theory of Relativity, in which electrodynamic laws also hold in every inertial frame, the Lorentz transformations entail that spatial and temporal separation are no longer invariant across inertial frames.

Perhaps the most famous consequence of this is the *relativity of simultaneity*. In classical physics, simultaneity is an absolute relation, and we may speak of two events as simultaneous *simpliciter*: two events *x* and *y* simultaneous in one frame are simultaneous in all, and simultaneity is an equivalence relation (reflexive, symmetric, and transitive). In Special Relativity, if *x* and *y* are simultaneous relative to one frame, they will not be simultaneous relative to some other frame moving inertially with respect to the first. Relative to a particular frame, simultaneity remains an

equivalence relation; but in general, if x is simultaneous with y in one frame, and if y is simultaneous with z in another, then we are not guaranteed that x will be simultaneous with z in either frame.

Equivalence relations are ubiquitous: for any sortal F, 'same F as' expresses an equivalence relation, and that, we are invited to suppose, is because 'same as' – identity – is an equivalence relation. But identity, perhaps the most hallowed of absolute equivalence relations among analytic philosophers, is, in the hands of relative identity theorists (Geach 1980), not absolute after all. On this view, asserting that x is identical with y is elliptical for 'x is the same F as y'. Since x may be the same F as y but not the same G – the same gold but not the same golden coin – identity emerges from the present reading, like simultaneity, as a relative equivalence relation. But regarding identity now as a three-place relation would scarcely incline many philosophers to judge it safely absolute, echoing again the intractibility of 'the' absolute/relative distinction.

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J. A. COVER

Abstract/Concrete

The process of abstraction, by which the mind somehow picks out a common feature of many individual items, has been discussed since at least Aristotle's *Posterior Analytics*. In traditional logic, abstract terms such as 'doghood' denote universals, while concrete terms such as 'dog' denote particulars. In more recent philosophy, 'abstract' and 'concrete' have been applied to the things denoted rather than to the denoting terms, with intent to classify all objects into two mutually exclusive and jointly exhaustive kinds (one of which may be empty). Although ordinary particulars are concrete and ordinary universals abstract (if objects at all), the modern distinction, the topic of this article, has diverged from the older one. Sets are abstract particulars, and Hegel did not contradict himself in speaking of concrete universals.

The association between abstract and universal survives in the Fregean notion that the 'criterion of identity' for an abstract object is an equivalence relation on its instances. Thus the identity of directions consists in the equivalence relation of parallelism between lines which have directions; lines have the same direction if and only if they are parallel (note that lines too may be abstract).

There are no agreed definitions of 'abstract' and 'concrete'. Many concrete objects exist contingently, are located in space and time, can be pointed at and perceived, have causes and effects, and change. Many abstract ones lack all these features. However, attempts to extract a rigorous criterion from such contrasts face the problem of objects which are neither purely abstract nor purely concrete; they do not clearly explain, e.g. why Plato is concrete, but the set with him as its only member is abstract.

Are there any abstract objects? If so, are they as mind-independent as concrete ones? A *Platonist* may be defined as one who answers both questions affirmatively. Many Platonists argue, after Plato, that all predication involves implicit reference to mind-independent abstract objects; they may exploit the permissibility of nominalizations such as 'doghood' and 'hairiness'. However, the case for Platonism seems to be at its strongest in the philosophy of mathematics. Three arguments for the existence of mathematical objects, assumed to be abstract, are:

1. '7' denotes something because it has the semantic function of a singular term in the true statement '7 is prime' (Frege).
2. The existence of mathematical objects provides the best explanation of mathematical intuition, just as the existence of physical objects provides the best explanation of perceptual experience (Gödel).

3. Mathematical existence claims figure in the mathematics which is an ineliminable part of our total physical theory, itself holistically confirmed by observation (Quine).

Arguments for the mind-independence of mathematical objects typically proceed from the claimed mind-independence of mathematical truth; they may be opposed by *constructivists* who view mathematical objects as mind-dependent. Common replies to arguments 1.–3. are:

1. Numerals do not really have the semantic function of singular terms (Wittgenstein).
2. Since mathematical objects are supposed to be outside space-time, it is hard to see how they can be responsible for our mathematical intuitions (Benacerraf).
3. Mathematical existence claims can be eliminated from our total physical theory (Field).

Naturally, there are replies to these replies. Much recent controversy has centred on the application of causal theories of reference and knowledge: if we cannot interact causally with mathematical objects, does it follow that we cannot refer to or know about them? Non-mathematical disciplines have also been said to need abstract objects (e.g. propositions in semantics). Some have argued that the natural sciences postulate properties and relations as well as particulars, and these universals might be conceived of as abstract objects.

For obvious reasons, the 'Pythagorean' view that all objects are abstract has been less popular than the view that they are all concrete. Quine's argument that our ontology could be interpreted as Pythagorean makes use of assumptions on which there is no fact of the matter as to what our ontology really is.

As often, the methodological principles of economy and conservativism pull in opposite directions. The former advises one not to multiply entities without necessity; the latter, not to abandon beliefs without necessity. If one's naïve view of the world embodies belief in a multiplicity of abstract entities (numbers, shapes, and virtues), should one seek to abandon that belief if one can, or only if one must?

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Abstraction

'Abstraction' has been used for numerous cognitive procedures, also for the entities (*abstracta*) thereby cognized, and more recently for sundry logical operations (set-, attribute-, lambda-abstraction) in which names for abstract entities are formed from non-nominal expressions by means of operators. Most forms of abstraction exhibit similar structural elements. The basis or input to an abstraction is one or more objects, *concreta*, with their complement of attributes. In abstraction, these attributes are partitioned into two classes: those which are retained, selected, or abstracted and those which are rejected, overlooked, or abstracted from. The end product or output is a new object, the *abstractum*, lacking the rejected attributes but inheriting the retained (or closely related) ones. In some theories abstraction may be iterated, using *abstracta* won in one round as *concreta* for the next round: for example, Aristotle thought numbers are abstracted from geometric *abstracta*.

Abstraction theories can be classified in several dimensions, according to the entities abstracted and the position adopted on these structural elements:

1. According to the *abstracta*. Mathematical objects (numbers, geometric

figures, sets, etc.), dependent moments, forms, universals, concepts, propositions, meanings, types, essences are all candidate *abstracta*.

2. According to the status of the *abstracta*. If *abstracta* pre-exist and are merely disclosed by abstraction, we have realism, whether Platonic (*abstracta* exist separately from *concreta*) or Aristotelian (*abstracta* exist in *concreta*). If abstraction creates *abstracta*, we have constructivism. If the constructs are mental, we have conceptualism. Sometimes 'nominalism' means a constructivism where the constructs are linguistic. If abstraction seems to disclose or construct *abstracta* but there really are none, we have fictionalism, which is sometimes also called 'nominalism'. The properties of *abstracta* also vary widely. Aristotelian *abstracta* are spatio-temporal, often perceivable, but dependent – incapable of separate existence – whereas Platonic *abstracta* are ideal: non-temporal, non-spatial, causally inert, immutable, unperceivable, etc. So 'abstract' can mean 'dependent', 'ideal', or (most properly) 'cognizable only by abstraction'.
3. According to the nature of the abstraction procedure. Psychological abstraction is a mental process (for example selective attention); if the *abstractum* is also psychological, as are John Locke's abstract ideas, we have psychologism. Edmund Husserl's method of intuiting essences, though he avoids the term 'abstraction', may be called phenomenological abstraction – it is a cognitive process 'purified' of psychologistic elements. Linguistic theories take abstraction as centred on the transition from concrete to abstract terms, whether via morphological devices like affixes ('-ness', '*-itas*', etc.) or syntactico-semantic devices like the generic 'the'. Regimented abstraction operators like set- and lambda-abstraction are given with axioms laying down existence and identity conditions for the abstract entities thereby introduced and are seen as incurring greater ontological commitments to corresponding *abstracta* than similar theories without the relevant operators.

Positions in these three dimensions may be fairly freely combined. Thus one may be a psychological conceptualist about either concepts (Locke) or universals (William Ockham), a phenomenological Platonist about species (Husserl), a nominalist constructivist about universals (Thomas Hobbes), or a fictionalist about numbers (Hartry Field). Aristotle combined realism about mathematical objects with fictionalism about their properties: although really in *concreta*, they are profitably treated as if they were separate (*Met.* M).

Abstraction is important to antirealists (constructivists, fictionalists) as the key to explaining how there seem to be mind-independent *abstracta*; it is important for some Platonic realists as an account of how *abstracta* are cognized which does not rely on occult faculties of intuition (such as are found in Plato or Kurt Gödel). Aristotelian realists (Avicenna, Thomas Aquinas, John Duns Scotus) often invoke abstraction to bridge the gap between individuals and universals: we perceive individuals, abstract from their matter, and retain a universal form in the mind. Use of abstraction to account for generality is a medieval development, which survived to become the keystone of many forms of empiricism. The conceptualist view that concepts or meanings come into being via abstraction ('abstractionism'), once a commonplace, has lost support under the criticisms of Ludwig Wittgenstein. Interest in abstraction has also been diminished by the tendency, following W. V. O. Quine, to offer pragmatic reasons (efficacy in organizing and expediting sciences) for ontological positions (in Quine's case, Platonism about classes).

The basis for a more precise grasp of abstraction emerged slowly from mathematics in the use of equivalence relations to establish new mathematical domains, for example by K. F. Gauss (1777–1855) in his theory of integer congruences, though the beginnings are in the account of ratios given by Euclid. Giuseppe Peano (1858–1932) recognized a general method which he called

'definition by abstraction' and his views were extended by Hermann Weyl (1885–1955), who introduced the notion of attributes invariant under an equivalence as being those retained in abstraction. Weyl was probably influenced by the Erlanger Programme of Felix Klein. This classified geometries in terms of their invariants, more general or 'abstract' geometries such as projective geometry sometimes being derived by "arbitrary but logically useful abstraction" (Weyl 1949, p. 74) from more 'concrete' ones. The invariants of projective geometry are properly included among those of affine geometry, these in turn among those of Euclidean geometry.

Richard Dedekind (1831–1916) regarded the natural numbers as a construction arising from simple infinite series by neglecting the special character of the elements and taking into account only the relations arising from their order. Dedekind's description of numbers thus abstracted as "a free creation of the human mind" (Dedekind 1901, §73) attracted the ire of Gottlob Frege, but Frege himself had rejected the idea that numbers are made cognitively accessible by abstracting under an equivalence only because this failed completely to determine identity conditions for *abstracta*. His solution, the introduction of extensions (later, value-courses) to provide fixed objects for numbers to be, is vulnerable to the same criticism, and he later resorted to *ad hoc* stipulations to decide identity questions, opening the way for conventionalism (Rudolf Carnap) and pragmatism (Quine) regarding *abstracta*. Bertrand Russell criticized Peano and advocated replacing definition by abstraction with the use of equivalence classes. Instead of taking the number 2 as that which abstraction finds all pairs to have in common, Russell regarded 2 simply as the class of all pairs. Although this approach is now almost universal in mathematics, its naturalness suffered through the need to restrict the size of sets to avoid paradoxes, thereby laying set-theoretic reductions open to charges of arbitrariness (Benacerraf 1965).

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Accidents I: History

Accident theory begins with the earliest attempts to distinguish between a thing and its properties, and it ends with the death of substance toward the close of the modern period. Accident as a formal category first appeared in Aristotle's *Categories*. For some interpreters accident, along with substance, is an ontological category; accident is a kind of entity. For others accidents are predicates only, ways of talking about individual substances. In starting this brief history with the *Categories* it would be remiss, however, not to mention that Plato in the *Phaedo* (1024-E) distinguishes between the form itself and the instance of that form in particular, thus the form of Tallness is distinct from the ('accident') tallness-in-Phaedo which is Phaedo's way of participating in Tallness. Aristotle's *Categories* is critical of Plato for treating tallness as belonging to the category of substance rather than the category of quantity. But Aristotle's categories involve much more than a distinction between a subject and its properties; they also commit Aristotle to a distinction between the kinds of properties which an individual (primary substance) may be said to have. The essential properties or secondary substances (species and genera) are those which endure through change and without which the individual cannot retain its identity. Essential properties are *predicable of* the individual. Accidents are *present in* the individual; an individual may undergo accidental change while retaining its identity. In a cryptic comment, Aristotle (in *Cat.* 2.1a20) notes that an accident is a 'this', presumably an individual in some sense. Accidents def-

initely are second-class citizens in the Aristotelian ontology; they do not contribute to the identity of an individual, play no role in scientific explanation, and are not an avenue of knowledge. As Aristotle notes, there is no science of the accidental.

Porphyry's works on Aristotle keep alive the ambiguity between accidents as ontological entities and accidents as predicates. This ambiguity dominates the two ways of treating accidents in the medieval period. If something is an accident *per se*, it is an entity, a reality, an ontological entity; if something is said *per accidens*, that is a way of saying something non-essential about a substance. Aquinas talks about accidents in both ways because he believes that although one can talk about things *per accidens*, accidents *per se* are needed in order to give a full account of natural change. Accidents *per se* are entities of explanation; medieval realists who posit substantial forms also posit accidental forms in order to explain change; nominalists, such as William Ockham, emphasize accidents as predicates, although Ockham thinks that they are irreducible predicates – that is, predicates necessary in order to give a complete description of the world. Thus, Ockham does not disagree with the realists in holding that accidents are necessary to science; the difference is that he means accidental predication and not accidents *per se*. If accidents in either sense are needed to give a full account of nature and one keeps the Aristotelian notion that scientific explanation requires necessary statements, then some way of incorporating accidents into scientific syllogisms must be found. Thus Scotus and Ockham try to distinguish accidental non-necessary predication (as in 'This wall is white') from accidental necessary predication (as in 'This wall is whiteable'), a distinction that is suggested in Aristotle's *Metaphysics* Δ. 30, 1025a30–5. Thus, the medieval philosophers begin the departure from Aristotle's claim in the *Posterior Analytics* I.6.75a19–20 that there is no science of the accidental.

If Aristotle claims that there is no science of the accidental, the modern philosophers of the 17th and 18th centuries come to hold that there is no science *except* the accidental. René Descartes begins the departure, leading the attack on the concept of Aristotelian substance. But if there is no Aristotelian substance that can underlie the accidents, serve in a scientific explanation, or be an object of knowledge, something else must be given these ontological roles. Descartes tries to collapse the distinction between substance and attribute, and attributes become the entities that were the subjects of modes, used in scientific explanation, and the proper objects of knowledge. Spinoza, the most systematic Cartesian, still uses the words 'substance' and 'attribute', but defines them as the same thing, that which is self-caused and can be known in itself. The attribute of extension is nothing more than the geometrical aspects of things; geometry for Descartes, Spinoza, and Leibniz becomes the very paradigm of scientific knowledge. But the shape and size of things is for Aristotle an accident, a quantity of which there could be no science.

The empiricist tradition in modern philosophy moves in a slightly different direction. Starting with Galileo, a sharp distinction is drawn between properties that can be quantified and are open to geometrical description – such as shape, size, motion, and rest – and those that are not – such as taste, smell, and texture. Galileo calls the first real and the second unreal accidents. The second are nothing but names. John Locke is not quite so willing to banish accidents of quality, but he draws a distinction between the primary qualities (powers in things to cause ideas of shape, size, and motion or rest) and secondary qualities (powers in things to cause ideas of smell, taste, and texture). The primary qualities are the proper study of science. In fact, it is the primary qualities of the atoms or corpuscles that are responsible for all of the accidents that are attributed to things. The primary qualities are the underlying causes of all ideas of things and they constitute the real essence of things. At this point substance as essence and its many ontological roles has been replaced with the geometrical accidents of things, and obviously the concept of a scientific explanation and the concept of cause have to change accordingly.

The role of accidents in causation was one of the great ontological debates of the

modern period. Descartes and Nicolas Malebranche often talk of an accident being communicated from one individual to another. Leibniz emphatically denies that such movement is possible; one individual can have no metaphysical influence on another. By this claim Leibniz means that an accident cannot transfer from one substance to another or exist in two individuals. To explain change without such metaphysical influence, Leibniz offers his theory of pre-established harmony.

If substance has been identified with attributes or its real essence is just a set of special accidents, it seems entirely possible that substance is ontologically nothing more than a set of accidents. George Berkeley argues that material substance is metaphysically, scientifically, and epistemologically useless. For Berkeley a material thing is nothing more than a collection of sensible qualities; David Hume applies the same analysis to minds and by the end of the modern period accidents or what are really their direct descendants, sensible qualities, are the basic ontological building blocks of reality. Even Kant, who tries to preserve the thing-in-itself, is clear that only sensible qualities are the appropriate objects of science.

Talk about qualities and properties, and even the debate between essential and accidental properties, has not vanished in the 20th century. There is the great nominalism–realism debate about whether properties are universal or particular, which involved Bertrand Russell, G. E. Moore, G. F. Stout, and C. D. Broad to name a few of the participants. There have been efforts to identify the 'simples' that occur in experience or out of which events are constructed and these were usually properties such as 'red', 'here', and 'round'. There have been ongoing debates about the nature of relations and whether the distinction between the relational and non-relational even makes sense. But these debates are not really about accidents, although they are about the kinds of things Aristotle and the other substance philosophers would have called accidents. These issues are not part of the development of accident theory as much as they are a debate about what kind of theory should replace accident theory once it is agreed that properties are no longer accidents which belong to a substantial individual.

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Accidents II: Accident Theory in Greek Philosophy

The notion of accident was not suddenly born from Aristotle's brain. It might be suggested that the pre-Socratic attempts to find out what the nature or φύσις of things really is (in contradistinction to their superficial and changing properties) were exercises in accident theory. Aristotle himself indicates that the Sophists used to build their fallacies on accidents (*Met.* 1026b15). Precise anticipations are to be found in Plato, e.g. in the *Euthyphro* (11a) where Socrates rejects an alleged definition of 'the pious', on the grounds that it does not denote the 'essence' (οὐσία) of the *definiendum*, but only an 'affection' (πάθος) of it.

It seems to be the case, however, that Aristotle first introduced in a systematic way both the concept of accident and the word συμβεβηκός as a designation of it.

The word is semi-technical. It is the perfect participle of συμβαίνειν, a quite common

verb, roughly meaning 'to walk along with', and hence 'to agree' (of persons), 'to correspond with' (of things), 'to happen' (of events), 'to result', or 'to follow' (of factual consequences or logical conclusions – Aristotle uses the verb in his definition of the syllogism, *Top.* 100a25, *Pr An.*. 24b18: the conclusion συμβαίνει from the premisses). The standard participial form συμβεβηκός sounds more technical; but its origins give it a rather wide range of meanings. Συμβεβηκός does not necessarily convey the notions of (1) contingency, (2) infrequency, and (3) painfulness (as 'accident' does in most modern languages). In a way, it could be helpful to translate it, not by the traditional 'accident', but by less heavily loaded words (like 'coincident' or 'concomitant'). However, it does convey at least 1. and 2. in the specific, but by no means unique, definition given by Aristotle at *Met.* 1025a14: "we call 'accident' what belongs to something and is true to say of it, but neither of necessity nor for the most part [ὡς ἐπὶ τὸ πολύ]". The complicated story of the notion, within Aristotle's work and after Aristotle, is largely rooted in this state of affairs.

In what seems to be the earliest and most influential Aristotelian statements about the accident (*Top.* 102b4–14), Aristotle offers no fewer than two different definitions of συμβεβηκός. Here, as well as in the definition in the *Metaphysics*, a συμβεβηκός is a kind of predicate, not a kind of event. The notion of accidental event is derivative: roughly speaking, something happens 'by accident' (κατὰ συμβεβηκός) when something x has an accidental predicate y, and is said to do or to undergo something under the description y.

The general context of the definitions in the *Topics* is a fourfold classification of kinds of predicates (in relation to specific, not individual, subjects: e.g. 'man', not 'Socrates'). The dialectical rules of discussion will vary, Aristotle argues, according to whether the predicate of the statement to be discussed is claimed to be the definition (ὅρος), or a 'property' or 'proprium' (ἴδιον), or a 'genus' (γένος), or an 'accident' (συμβεβηκός) of the subject. This classification follows from a cross-application of two distinct criteria (cf. *Top.* 103b6–19):

1. either the predicate does or does not belong to the essence of the subject, and
2. either the predicate has or does not have the same extension as the subject.

The definition is essential and coextensive; the property is coextensive and not essential; the genus is essential and not coextensive; the accident is neither essential nor coextensive. This is the dominant picture in *Topics* I.

Let us turn now to the actual Aristotelian definitions of accident, and say something about the problems involved. The first definition reads:

> (A1) An accident is something which, though it is none of the foregoing – i.e. neither a definition nor a property nor a genus – yet belongs (ὑπάρχει) to the thing (102b4–5).

This definition might be expressed in the following way (using $S(A,B)$ = 'A is a συμβεβηκός of B'; $E(A,B)$ = 'A reveals the essence of B'; $C(A,B)$ = 'A is coextensive with B'; $Y(A,B)$ = 'A belongs to B'):

$$\text{(A1a)}\quad S(A,B) =_{\text{Df.}} Y(A,B) \;\&\; \neg E(A,B) \;\&\; \neg C(A,B)$$

The negations in (A1) are not, however, necessarily to be construed as actual exclusions as they are in (A1a); they might mean that the συμβεβηκός just belongs to the subject, leaving open the question whether it has or does not have the supplementary features of essentiality and coextensivity. This gives a weak interpretation of (A1), namely:

$$\text{(A1b)}\quad S(A,B) =_{\text{Df.}} Y(A,B).$$

This weak sense of 'accident' accounts, I suggest, for some otherwise puzzling aspects of the use of συμβεβηκός in the *Topics*. Aristotle often says or implies that, in order to establish or to reject an accident-claim, it is enough simply to show that the predicate does or does not belong to the subject (cf. 139a24–b5; 155a3–36).

Aristotle's second definition of accident now reads:

(A2) An accident is something which may (ἐνδέχεται) possibly either belong or not belong to any one and the self-same thing (ὀτῳοῦν ἑνὶ καὶ τῷ αὐτῳ) (102b6–7).

The examples which follow are specifically fitted to (A2): "for instance 'to be sitting' may belong or not belong to some self-same thing", etc.

According to Aristotle himself, (A2) is a 'better' definition than (A1). In order to understand (A1), one must already know the three other notions listed, where (A2) is 'self-sufficient'. This epistemic privilege of (A2) does not, however, imply any logical difference between (A1) and (A2): they are most probably intended to capture a single notion.

Do they actually do so? The complicated history of the concept has been largely determined by the puzzles to which this question gives rise. Standardly interpreted, (A2) apparently means:

(A2a) $S(A,B) =_{\text{Df.}} Y(A,B) \& \Diamond \neg Y(A,B)$.

(A2a) seems to rule out the predicates which are in some (factual, conceptual, or other) sense inseparable from their subject, whereas such predicates could fall under (A1) in both its interpretations. Such is the case, apparently, with Aristotle's own *'per se* accidents' (συμβεβηκότα καθ' αὐτά), defined as "those which belong to their subject *per se* [hence necessarily], without being in its essence" (*Met.* 1025a31–2), and described as the proper predicates of demonstrated scientific conclusions (*Post. An.*, 75b1; 76b11–16).

'Inseparable accidents' crop up repeatedly in the history both of συμβεβηκός and of the Aristotelian tradition. Epicurus (*Ep. Hdt.* 68–71) restricts the use of the word συμβεβηκότα to inseparable qualities, in contradistinction to συμπτώματα, transitory qualities (respectively *coniuncta* and *euenta* in Lucretius's Latin, *DRN* I 449–82). On the other hand, Alexander of Aphrodisias, commenting upon the *Topics* definitions (48,28–49,1 Wallies), discusses various kinds of 'inseparability' and various interpretations of 'possibility' in (A2). He eventually concludes that (A1) and (A2) are not logically equivalent, and that (A1), if not 'better' than (A2), is nevertheless 'necessary'. This is because it can cope with cases of accidents which do not fall under (A2), namely "those which belong inseparably (ἀχωρίστως) to their subjects, without being in their essence and without being properties of them".

Porphyry (*Isagoge* 12,24–13,5 Busse) puts forward another solution, which was to prove enormously influential. He introduces (together with two other definitions directly adapted from Aristotle) a new definition, following from one of Alexander's suggestions, and according to which:

(AP) An accident is that which appears and disappears without entailing the destruction of the subject.

This definition is explicitly designed to take care of both 'separable' and 'inseparable' accidents: for, Porphyry adds, there are two kinds of accidents, separable ones which obviously fall under (AP), and certain others, which are factually inseparable, but which still fall under (AP), because the subject can at least psychologically be conceived of without them, without thereby being destroyed.

It is not quite obvious that (AP) captures the Aristotelian notion of accident. Its faithfulness to Aristotle has been recently questioned by T. Ebert (1977), who (taking over a suggestion made, but abandoned, by Alexander) powerfully argues that the real meaning of (A2) in Aristotle is not (A2a), but:

(A2b) $S(A,B) =_{\text{Df.}} Y(A,B) \& (EC)$ $(\Diamond Y(A,C) \& \Diamond \neg Y(A,C))$.

In other words, A is an accident of B iff (1) A belongs to B, and (2) there is a C such that A may belong and not belong to C. Accordingly, a given predicate, if it satisfies (2), will be an accident in respect to whatever subject it may be related to, even if it is in some sense 'inseparable' from this subject.

This interesting suggestion is certainly at least compatible with the text of (A2); and it makes excellent sense of some puzzling

passages in the *Topics* (e.g. 120b21–35). However, it may be doubted that it solves all the difficulties, because it seems to be demonstrably possible, in Aristotle's view, for a given predicate to be an accident of a subject *A*, and to belong in some non-accidental way to a subject *B*.

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Accidents III: The Ontological Square

The phrase 'ontological square' is found for the first time in Angelelli (1967), Chapter 1. It refers to a *diagram* often included in early editions of logic books and manuscripts but above all to a *theory* which has largely dominated the history of metaphysics. This theory has its first formulation in Aristotle's *Categories*, 1a20–1b10. Aristotle explains that there are four classes of entities (ὄντα) generated by the combination of two relations. The two relations are: '*x* is predicated of *y*' and '*x* is in *y*'. The first class of entities consists of those that are not in others but are predicated of others; the second class of those that are not predicated of others but are in others; the third of those both predicated of others and in others; and the fourth of those neither predicated of others nor in others.

The relation of 'being in' holds between accidents and substances, and has often been referred to as 'inherence'. The relation of 'being said of', or predication, holds between universals and particulars (in pre-Fregean logic also to other, 'inferior', universals). Thus, the four classes have been traditionally known as:

1. universal substances,
2. particular or individual accidents,
3. universal accidents,
4. individual substances.

Thus, in Pacius's commentary on the *Organon* of 1598 we read: "*rerum divisio quadripartita, aut enim est substantia universalis, aut substantia particularis, aut accidens universale, aut accidens particulare*".

In Angelelli (1967) the square appears as follows:

	not being in a subject	being in a subject
said of a subject	man	white
not said of a subject	this man	this white

It may be unclear whether Aristotle fully recognizes individual accidents in the real world in addition to the three other types of entities. However, the acceptance of this fourth type became well established in the Aristotelian and scholastic tradition. There were many 'axioms' for individual accidents: 'individual accidents cannot pass from one subject to another subject', 'individual accidents cannot be in two subjects', etc.

In spite of the clarity of the definitions involved in the theory of the ontological square, the associated terminology has often tended to be dangerously ambiguous (for example, '*inesse*' as a term designating either one of the two basic relations; 'accident' as referring both to universal and to individual accidents).

Two powerful ideas have acted against the sharp separation of the four classes of entities:

1. the notion of essence,
2. the view of universals as merely 'mental',

so that the only 'real' classification has been held by many to be the division between accidents and substances.

In the historical development of the ontological square, interesting discussions have emerged on the possibility of reiterating either of the two basic relations. In the case of 'being in' (inherence) this became the issue of whether to admit accidents of accidents (for example: white – an accident from the category of quality – is in surface – an accident from the category of quantity – where the surface in question is in some given individual substance). Here classical ontologists, for example Francisco Suárez (*Disputationes Metaphysicae*, XIV, 4) seem to have favoured parsimony. In the case of the relation 'said of', however, the attitude appears to have been, in general, far more liberal: predicates of predicates proliferated and were subject to a sophisticated treatment under the heading of 'second intentions'.

Curious questions have also been considered, such as for example the general lack of proper names for individual accidents.

A surprising, unusual formulation of the ontological square is found in *De veris principiis et vera ratione philosophandi contra pseudophilosophos libri IV*, 1533, of the humanist Marius Nizolius (1498–1576), who wanted to replace universals by collections or *multitudines*, and accordingly had, instead of 'universal substances', *multitudines singularium substantiarum* (sets of singular substances), and instead of 'universal accidents', *multitudines singularium qualitatum* (sets of singular qualities).

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Accidents IV: The Ontological Hexagon

The ontological hexagon presented in this article is an extension and modification of the Aristotelian ontological square, which is an *ontological* pendant to Aristotle's *logical* square of oppositions.

At the beginning of the *Categories*, from 1a20 to 1b9, Aristotle exhibits two relations in which entities can or cannot stand. The first of these is the relation of ἐν ὑποκειμένῳ εἶναι = *in subiecto esse* = to be ('inhere') in a subject, which we abbreviate by 'enh'. The second is the relation of καθ' ὑποκειμένου λέγεσθαι = *de subiecto dici* = to be said ('predicated') of a subject, which we abbreviate by 'cath'.

Using the relations 'enh' and 'cath', Aristotle considers, purely combinatorially, four sorts of entities. The names attached thereto are not found in Aristotle; they stem from the tradition.

enh	cath	
−	−	(singular substances, SS)
−	+	(universal substances, US)
+	−	(singular moments, SM)
+	+	(universal moments, UM)

Here + means that the entity in question bears the relation in question to some subject, and − means the negation of this.

Traditionally, moments are called accidents. But we prefer the term 'moment' (roughly in the Husserlian sense), since it is then possible to distinguish between essential and accidental moments. The term 'moment' has, unlike the term '*accidens*', no modal connotations. Let us give some examples of each of our four sorts of entities:

- SS: this individual man, star, stone, this soul.
- US: classes or concepts of SS's, the class of all men, the concept of star.
- SM: this individual fall, cry, reddening, being hot.
- UM: classes or concepts of UM's, like the class of all falls, the concept of reddening.

For more on moments see Smith (1982).

passages in the *Topics* (e.g. 130b21–35). However, it may be doubted that it solves all the difficulties, because it seems to be demonstrably possible, in Aristotle's view, for a given predicate to be an accident of a subject A, and to belong in some non-accidental way to a subject B.

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JACQUES BRUNSCHWIG

Accidents III: The Ontological Square

The phrase 'ontological square' is found for the first time in Angelelli (1967), Chapter 1. It refers to a *diagram* often included in early editions of logic books and manuscripts but above all to a *theory* which has largely dominated the history of metaphysics. This theory has its first formulation in Aristotle's *Categories*, 1a20–1b10. Aristotle explains that there are four classes of entities (ὄντα) generated by the combination of two relations. The two relations are: '*x* is predicated of *y*' and '*x* is in *y*'. The first class of entities consists of those that are not in others but are predicated of others; the second class of those that are not predicated of others but are in others; the third of those both predicated of others and in others; and the fourth of those neither predicated of others nor in others.

The relation of 'being in' holds between accidents and substances, and has often been referred to as 'inherence'. The relation of 'being said of', or predication, holds between universals and particulars (in pre-Fregean logic also to other, 'inferior', universals). Thus, the four classes have been traditionally known as:

1. universal substances,
2. particular or individual accidents,
3. universal accidents,
4. individual substances.

Thus, in Pacius's commentary on the *Organon* of 1598 we read: "*rerum divisio quadripartita, aut enim est substantia universalis, aut substantia particularis, aut accidens universale, aut accidens particulare*".

In Angelelli (1967) the square appears as follows:

	not being in a subject	being in a subject
said of a subject	man	white
not said of a subject	this man	this white

It may be unclear whether Aristotle fully recognizes individual accidents in the real world in addition to the three other types of entities. However, the acceptance of this fourth type became well established in the Aristotelian and scholastic tradition. There were many 'axioms' for individual accidents: 'individual accidents cannot pass from one subject to another subject', 'individual accidents cannot be in two subjects', etc.

In spite of the clarity of the definitions involved in the theory of the ontological square, the associated terminology has often tended to be dangerously ambiguous (for example, '*inesse*' as a term designating either one of the two basic relations; 'accident' as referring both to universal and to individual accidents).

Two powerful ideas have acted against the sharp separation of the four classes of entities:

1. the notion of essence,
2. the view of universals as merely 'mental',

so that the only 'real' classification has been held by many to be the division between accidents and substances.

In the historical development of the ontological square, interesting discussions have emerged on the possibility of reiterating either of the two basic relations. In the case of 'being in' (inherence) this became the issue of whether to admit accidents of accidents (for example: white – an accident from the category of quality – is in surface – an accident from the category of quantity – where the surface in question is in some given individual substance). Here classical ontologists, for example Francisco Suárez (*Disputationes Metaphysicae*, XIV, 4) seem to have favoured parsimony. In the case of the relation 'said of', however, the attitude appears to have been, in general, far more liberal: predicates of predicates proliferated and were subject to a sophisticated treatment under the heading of 'second intentions'.

Curious questions have also been considered, such as for example the general lack of proper names for individual accidents.

A surprising, unusual formulation of the ontological square is found in *De veris principiis et vera ratione philosophandi contra pseudophilosophos libri IV*, 1533, of the humanist Marius Nizolius (1498–1576), who wanted to replace universals by collections or *multitudines*, and accordingly had, instead of 'universal substances', *multitudines singularium substantiarum* (sets of singular substances), and instead of 'universal accidents', *multitudines singularium qualitatum* (sets of singular qualities).

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IGNACIO ANGELELLI

Accidents IV: The Ontological Hexagon

The ontological hexagon presented in this article is an extension and modification of the Aristotelian ontological square which is an ontological pendant to Aristotle's logical square of oppositions.

At the beginning of the *Categories*, from 1a20 to 1b9, Aristotle exhibits two relations in which entities can or cannot stand. The first of these is the relation of ἐν ὑποκειμένῳ εἶναι = *in subiecto esse* = to be ('inhere') in a subject, which we abbreviate by 'enh'. The second is the relation of καθ' ὑποκειμένου λέγεσθαι = *de subiecto dici* = to be said ('predicated') of a subject, which we abbreviate by 'cath'.

Using the relations 'enh' and 'cath', Aristotle considers, purely combinatorially, four sorts of entities. The names attached thereto are not found in Aristotle; they stem from the tradition.

enh	cath	
−	−	(singular substances, SS)
−	+	(universal substances, US)
+	−	(singular moments, SM)
+	+	(universal moments, UM)

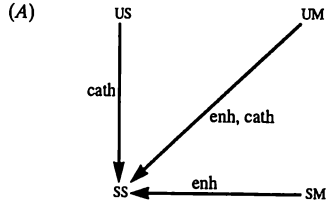
Here + means that the entity in question bears the relation in question to some subject, and − means the negation of this.

Traditionally, moments are called accidents. But we prefer the term 'moment' (roughly in the Husserlian sense), since it is then possible to distinguish between essential and accidental moments. The term 'moment' has, unlike the term '*accidens*', no modal connotations. Let us give some examples of each of our four sorts of entities:

- SS: this individual man, star, stone, this soul.
- US: classes or concepts of SS's, the class of all men, the concept of star.
- SM: this individual fall, cry, reddening, being hot.
- UM: classes or concepts of UM's, like the class of all falls, the concept of reddening.

For more on moments see Smith (1982).

The Aristotelian ontological tetragon then looks like this:

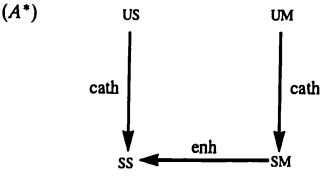


We have drawn a labelled arrow if and only if there are corresponding pairs of entities between which the labelled relation can hold.

The Aristotelian ontological square poses many problems (see Angelelli 1967). Here we restrict our attention to the following two questions:

1. Why is there no cath-arrow from UM to SM, whereas there is such an arrow from US to SS?
2. Why are there both an enh-arrow and a cath-arrow from UM to SS?

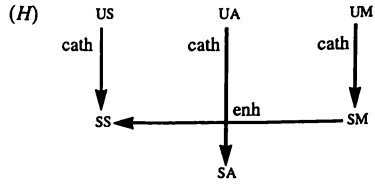
The trivial answer to these questions is: because Aristotle has *defined* the four classes just in terms of the relations cath and enh in the way described above. If, however, we appeal to an independent understanding of SS, US, SM and UM and also of cath and enh, then the following modified Aristotelian ontological tetragon can be suggested:



Here cath is understood strictly as predication, and thus a universal moment is predicated of a singular moment, just as a universal substance is predicated of a singular substance. A universal moment is not predicated of any substance either singular or universal, simply because a substance is not a moment.

How do we understand enh? We understand it as the inherence relation between a singular moment and the singular substance which 'bears' this moment. Thus a universal moment does not inhere. If a thing is red, then it is so because a concrete, singular spatio-temporal redness inheres in the thing and not because redness as such inheres therein.

We may now extend the modified Aristotelian tetragon to a hexagon by introducing two new vertices, and new edges:



Explanation of (*H*). Here the SA's are singular states of affairs, the UA's are universal states of affairs. It is useful to consider the UA's as concepts under which the SA's can fall. Thus under the concept 'that a man runs' there fall all singular states of affairs consisting of a man and a run which inheres therein.

We could also add the new relations *part* and *sub*. *Part* denotes the mereological part–whole relation; it can hold only between singulars. *Sub* is the relation of subordination or inclusion and can hold only between universals, as for example between man and animal, between redness and colour.

The distinction between UA's and SA's allows a new definition of the truth of (simple) sentences.

> S is true: $=_{Df.}$ there is a singular state of affairs σ such that the universal state of affairs $\|S\|$ can be predicated (cath) of σ.

To summarize, the ontological hexagon incorporates the following simple ontological picture: there are three categories: substances, moments, and states of affairs. In each category we have both universals and singulars (individuals). The universals of a fixed category stand e.g. in the *logical* relation of subordination to one another (the UA that a man runs is subordinated to the UA that an animal moves). The universals stand

to the corresponding singulars in the *ontological* relation of predication (cath). Between the singulars we have *ontic* relations, like enh and part. Further, such ontic relations would be the relation of causation, holding between singular states of affairs, or the relation of temporal succession, holding between singular moments.

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J. WOLFGANG DEGEN

Acquaintance

Acquaintance is *direct awareness*, what the medievals called 'intuitive cognition' (*cognitio intuitiva*) and later philosophers called simply 'intuition'. More precisely, acquaintance is a *singular* awareness of a particular object *in one's presence*. The paradigm is perception, where the subject is in causal contact with the object of awareness, but it has also been held that we are directly aware of our own conscious mental states and of ourselves as subjects. The way in which these forms of awareness are 'direct' has been analysed quite differently by different philosophers.

John Duns Scotus and William Ockham defined intuitive cognition as grasping individual objects through the senses, which they opposed to 'abstractive cognition' in grasping the universal through the intellect. Similarly, in the *Prolegomena* Kant said, "Intuition [*Anschauung*] is a representation [*Vorstellung*] such as would depend directly on the presence of the object". For Kant, intuition in sense perception results from an interaction of both sensation and judgement. The classical theories in the 20th century are those of Bertrand Russell and Edmund Husserl.

Russell. In his 1910 essay "Knowledge by acquaintance and knowledge by description", Russell says, "I am *acquainted* with an object when I have a direct cognitive relation to that object." This notion is explained partly in terms of Russell's distinction between 'knowledge by acquaintance', wherein one knows an object directly, and 'knowledge by description', wherein one knows an object indirectly by way of some description, as 'the so-and-so'. Russell recognized four kinds of acquaintance: perception of sense-data, introspection of certain mental occurrences, introspection of oneself, and conception of universals – i.e., properties and relations. He vacillated, however, on whether one knows oneself by acquaintance, and he held that we know other selves and physical objects only by description – e.g., as the cause of these sense-data.

For Russell, the ontological structure of acquaintance is that of a two-place relation between subject and object: say, between me and this red round patch, the sense datum I am seeing. It is a *direct* cognitive relation, because it is not mediated by anything like a property or a general concept. By contrast, knowledge by description is a mediated cognitive relation. For instance, when I believe that the winner of the next American presidential election will be a Democrat, I stand in a certain cognitive relation to the winner, but that relation is mediated by the property of winning the election, which belongs uniquely to the winner. On Russell's analysis, I am acquainted with the 'constituents' of the 'proposition' I believe, which in this case include the given property. However, for Russell there is no such entity as the proposition itself, and so believing is a relation between the subject and those constituents.

Husserl. Husserl gives a quite different account of intuition, developed in various works including his *Logical Investigations* (see VI, §46), *Ideas* (§1), and *Cartesian Meditations* (§§1, 24–6). Husserl defines intuition (*Anschauung*) as a direct 'experiencing' (*Erfahrung*) of an object 'itself', an object given as 'present'. This form of awareness he also calls 'evidence' (*Evidenz*). Husserl recognized three basic kinds of intuition: perception of physical objects and events (not sense-data); phenomenological reflection upon one's experiences (and their contents) and also upon oneself (one's pure 'ego'); and 'eidetic' apprehension of 'essences' – i.e., species or attributes. Husserl

also recognized a secondary kind of intuition, which he called 'reproductive': this kind includes recollection, fantasy, and empathy. In these types of experience an object is given not directly, as in 'originary' intuition, but 'as if' directly – for instance, when I recall what I once saw 'as if' I were seeing it once more.

The ontological structure of intuition follows that of intentional relations on Husserl's general theory of intentionality. (See *Logical Investigations*, V, and *Ideas*, §§88ff, 128ff.) Some scholars read the later Husserl as an idealist, while others read him always as a realist. On the realist reading, Husserl distinguishes the 'act' or intentional experience (*Erlebnis*), from its subject, its content, and its object. My seeing this dog (veridically) consists, then, in an intentional relation mediated by the content of my experience: I *have* a visual experience, the experience *bears* (or contains) the content, and the content *prescribes* (or is satisfied by) the dog. Thus, the intentional relation between subject and object is really a four-term relation between subject, experience, content, and object.

The content of the experience reflects the way the object is 'given' in the experience. Husserl first identified the content of an experience with the 'ideal species' of the experience (*Logical Investigations*, V); later he assumed it to be another kind of abstract entity he called 'noema' (*Ideas*, §§88ff), something rather like Frege's *Sinn*. Either way, Husserl assumed that the object of the experience is determined by the content of the experience, somewhat as Frege assumed that the referent of an expression is determined by the sense of the expression. By contrast, Russell argued against the existence of 'contents' and simply identified seeing with a two-term relation between subject and object, as opposed to Husserl's four-term relation of the subject's having an experience bearing a content determining the object.

What distinguishes intuition from other intentional relations, for Husserl, is the content involved. An *intuitive* experience is a self-evident presentation of an object 'itself' in one's 'presence'. Its content reflects the way the object is given, and it is that type of content that makes intuition a 'direct' awareness of the object. Even a 'direct' cognitive relation of intuition, then, is mediated in its ontological structure by a content, a content reflecting an intuitive form of givenness. In perception, moreover, the experience is itself the result of interpretation (*Auffassung*) of sensations, or 'hyle', which stand in a causal relation to the object of acquaintance. (The interpretation and sensations are not independent experiences; they are 'moments', or dependent parts, of the perceptual experience.) So the perceptual relation of subject to object would seem to involve – or at least depend on – a causal relation between the subject's experience and the object. However, to describe the experience and its content as such, in a purely phenomenological description, Husserl would 'bracket' (i.e. make no use of assumptions concerning) this causal relation, along with the existence and actual properties of the object that is perceived.

Causal Theories. Causal theories of perception – advanced by H. P. Grice, for instance, with roots in John Locke and David Hume – suggest a *causal* approach to acquaintance, analysing the acquaintance relation at least partly in terms of the causal relation between subject and object. The traditional causal theory of perception holds that a necessary (if not sufficient) condition for my seeing an object is that the object must play an appropriate role in causing my visual experience of the object. An extreme causal theory would simply identify visual acquaintance with the appropriate causal relation between subject and object. But then acquaintance would not seem to be a properly cognitive or intentional relation; in particular, content would play no role in acquaintance. A subtler ontology would hold that the acquaintance relation *depends on* the causal relation, or that the visual experience depends causally on the object's presence.

But the causal approach must be generalized. If I am directly aware of the experience I am having, I stand in a *contextual* but not causal relation to the object of my awareness: I am *having* but not causing the experience of which I am aware (my relation to the experience is 'contextual' because it is part of the immediate context of the experience). And if I am directly aware of myself as subject of the

experience, again I am the *subject of* but not the cause of that awareness. Thus, we might say acquaintance is an 'indexical', or context-dependent awareness: a perceptual awareness of 'this' object causing my perceptual experience, or an awareness of 'this experience' I am now having, or of the 'I' who is having this experience. Acquaintance is thus a cognitive, or intentional, relation that *depends* in a relevant way on the context of awareness – and on a content of experience.

In sum, an adequate theory of acquaintance must account for several ontological features of the relation of acquaintance:

1. The *type* of relation (is it an intentional relation, a contextual relation, or somehow both?).
2. The *terms* of the relation (is the relation mediated by a discrete experience, or by a content, or by parts of the context?).
3. The factors on which the relation *depends* in various ways (the experience, the content, the causal or contextual relations between subject and object?).

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Action

There is a crucial distinction between what we do and what happens to us, between raising one's arm and one's arm merely rising because of a nervous twitch. Leaving aside special circumstances, we are free in and morally responsible for only what we do. Despite some disparity with ordinary usage, what we do is identified in the recent literature as human action. The key question about action is how to distinguish it from other events involving persons.

One interesting answer, which has its roots in Thomas Reid's *Active Powers* (1788), is that an action is an event caused by a substantial self, or agent (cf. Roderick M. Chisholm). Some problems for this proposal are specifying the nature of an agent and the non-efficient causal relation this substance bears to behavioural events.

A number of answers focus on the causal chain comprising action. When I raise my arm, there is a chain from my desire and belief (both of which might be identical with neurophysiological events) to events in my central nervous system, to muscle movements, and eventually to my arm's rising. The *Oldtime Volitional Theory* (e.g. John Stuart Mill, *Logic*, 1843, Book 1, Chap. iii) identifies an action with this entire causal chain. This is a reductive account. Formally, action language is eliminated in favour of reference to non-actional events and causal relations. The main difficulty is sustaining reductive status. In bodily action, the theory says, approximately, that for any person S and action A, S performs A *if* there is a causal chain from S's wanting and believing to some behaviour B of S. But which behaviour? Suppose I want to raise my arm and believe I can do so, but that my arm is paralysed and only my shoulder twitches. The right-hand side of the biconditional must say that B is associated with action A. But this clause defeats the reductive status of the theory, since there is no means of explicating being associated without invoking action.

Another approach is to identify the action only with the primary mental events in the chain. The behaviour, such as my arm's moving, is then the effect of an action. This view, the *Mental Action Theory*, was held by H. A. Prichard (1871–1947), who argued that to act is to will something, as well as by some contemporary philosophers, such as J. Hornsby, who identify action with a person's mentally trying. One objection – perhaps not

a defeating one – is that the theory is contrary to common sense. We ordinarily hold people responsible for what they do; we observe them acting, and so on. In these cases we are concerned with physical activity, not with what happens in one's head. A more difficult problem is explicating the nature of the mental event identified with action. Labelling it 'willing' or 'volition' does not solve the problem. Nor does identifying it with trying, since trying is commonly understood as completing one overt action in the service of another, as trying to lift a weight is to do something, say grasping it and pulling it up, in order to lift it. The concepts of volition and willing appear obscurantic.

The Mental Action Theory is a functional account; it identifies action by its causal role. Another functional approach, the *Causal Theory*, identifies action with the effects of primary mental events. It is the most widely held view, favoured for example, by Donald Davidson, A. Goldman, Hector-Neri Castañeda, John Searle, and Myles Brand. The difference between my raising my arm and my arm's merely going up is that only the former is caused by the appropriate antecedent mental events.

The fundamental issue for the Causal Theory is specifying the prior mental events. Goldman and others take them to be a complex of belief and desire; however, that permits causally wayward chains. Following Davidson, suppose that a man, while climbing, finds himself supporting another person on a rope. He wants to rid himself of the danger, and believes that he can do so by loosening his grip. This belief and desire unnerve him and cause him to loosen his hold. Here the climber did not perform the action of releasing the rope, despite his releasing it being caused by a belief–desire pair. Nervousness intervened. We need, instead, to identify mental antecedents that are typically the *proximate* cause of action.

The proximate cause must have cognitive features; it must be capable of guiding and monitoring the resultant bodily movements. In all but the simplest actions, these bodily movements must be conceived within the context of a pattern of activity. The mental antecedent cannot, however, be purely cognitive. I might strongly believe that I will jump up and touch the ceiling; but unless I am *moved* to act, I will not jump. That is, the antecedent must have conative, motivational features. The type of ordinary mental event closest to having all these features is intending.

In sum, the Causal Theory provides a highly plausible answer to the key question: actions are distinguished from other events in that they are proximately caused by mental events with appropriate cognitive and conative features. Note that philosophical analysis is inherently limited in explicating the nature of this type of mental event. Beyond specifying foundational constraints, the project passes to the special sciences, to cognitive and motivational psychology, artificial intelligence, and neuroscience.

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MYLES BRAND

Adverbial Theory

The adverbial theory was invented by Curt John Ducasse in 1951 and is now advocated by analytical philosophers such as Wilfrid Sellars and Roderick Chisholm, and criticized from a phenomenological point of view, for example, by Panayot Butchvarov. The theory is used to deal with ontological problems of intentionality resulting from the fact that the world may appear other than it is and that we can direct our intentional attitudes towards things that do not exist. In what

follows I shall examine especially Chisholm's version of the theory and employ his ontology of properties as a means of modifying certain aspects of his views.

In the adverbial theory, sentences referring to intentional phenomena and containing terms that seem to refer to non-existent objects are translated into adverbial expressions. Thus,

John thinks of a unicorn

is translated into:

John thinks unicornically.

This sentence does not suggest the fallacious conclusion to:

($\exists x$ is a unicorn and John thinks of x).

Chisholm, however, used the theory especially to describe phenomena of perception, or, more exactly, of appearing. Thus he proposed replacing sentences like

Something red is appearing to me

with the adverbial rendering:

I am being appeared to redly.

To explain the meaning of the latter, Chisholm compares it with the sentence 'She feels sad'. Yet he also states an epistemic principle to the effect that:

> *Being appeared redly to* tends to make it evident to the subject that there is something that appears redly to him.

Yet we cannot state a similar principle concerning someone's being sad, precisely because *being appeared to*, unlike *being sad*, points to or is directed towards an object, as Franz Brentano and the phenomenologists would say. That is why Butchvarov is right in saying that the adverbial theory does not do justice to intentionality.

Moreover, it is hard to see how the theory could do justice to those of our intentional attitudes which are directed towards existing objects of the external world, if the epistemic principle stated above is to be applied. The unrestricted application of the adverbial theory would thereby lead us to a scepticism concerning our knowledge of the external world.

If, on the other hand, the theory is applied exclusively to those sentences about intentional phenomena (of perception) which seem to involve non-existing objects – which is Chisholm's intention – then we offend against the principle that there is no descriptively or phenomenologically identifiable difference between those intentional phenomena which have existing things as objects and those which do not. The principle was pointed out by Edmund Husserl, according to whom "nothing changes in the phenomenological respect" in the act of consciousness, whether the intended object exists or not. "I do not imagine Jupiter in a different way than Bismarck", Husserl says in the fifth of his *Logical Investigations*. Thus the appearing of something red is not distinguishable in a descriptive way from being appeared redly to; otherwise we would not be mistaken so often with respect to the objects of o perceptions.

If, then, an adverbial theory is to defensible, it has to be a theory which appli to every intentional phenomenon, or at leas to every phenomenon of a certain kind, e.g. perception.

Chisholm's ontology of properties allows the adverbial theory to be restated in such a way that it withstands the above-mentioned objections. His theory runs as follows. Whatever is capable of being exemplified is a property. Properties (P, Q, and so on) can be logically connected according to the following two definitions:

> P implies $Q =_{\text{Df.}}$ P is necessarily such that if anything has it then something has Q.

> P includes $Q =_{\text{Df.}}$ P is necessarily such that whatever has it has Q.

Thus the property of *sitting on a table* implies, and includes, *sitting*, and it implies but does not include *being a table*. In addition to these

logical connections, Chisholm also defines what we might call an intentional-logical connection:

> *P* involves $Q =_{Df.}$ is necessarily such that whoever conceives it conceives *Q*.

Involvement differs from implication and inclusion in the following way: each of the four properties *being red or round*, *being non-red*, *being possibly red*, and *wanting something that is red* involves the property *red*, for one cannot conceive these properties without conceiving *red* as well.

Let us return now to our examples: *feeling sad* and *being appeared redly to*. According to Chisholm these are properties which include every property they imply or involve. This is true as far as the property *being sad* is concerned, for every property it involves or implies is had by the person who is sad.

The property *being appeared redly to*, on the contrary, clearly involves a property it does not include, namely *red*, because one cannot conceive the former without conceiving the latter. One cannot distinguish between *being appeared redly to* and *being appeared greenly to* without conceiving the properties *red* and *green*. But the latter two properties are not necessarily had by the one who is appeared redly or greenly to.

Chisholm says that *being appeared redly to* and *being appeared greenly to* are just two different experiences like *feeling sad* and *feeling great*. But he overlooks the fact that the former two cases are intentional experiences, i.e. directed towards an object, while the latter are not. Someone who experiences redly is not and is not supposed to be red himself, whereas someone who feels sad is himself sad.

A modified adverbial theory might now read as follows: any property of perception such as *seeming to see thus and so* or *being appeared to thus and so*, where the 'thus and so' can be replaced by an adverb, includes every property it implies, but it involves properties it does not include or imply, namely *being seen* and *appearing* on the one hand and *being thus and so* on the other.

This can also be said about the property of *seeing thus and so*, because if the expression 'thus and so' is replaced by an adverb, say 'foxly', then our property does not imply the property of *being a fox*. Hence we can say: *perceiving thus and so* includes every property it implies, but it involves at least one property it does not include or imply, namely *being thus and so*.

We are now in a position to analyse a somewhat difficult example: consider the situation where John sees a dog and takes it for a fox, a situation which could be rendered adverbially as:

> John sees foxly a dog.

This should be paraphrased as:

> John has the property of *seeing foxly a dog*.

This property

1. implies and involves properties it also includes, e.g. *seeing something*;
2. implies and involves properties it does not include, e.g. *being a dog*;
3. involves properties it neither implies nor includes, e.g. *being a fox*.

This last property, however, does not include the property of *seeing a dog*. In other words: the property of *being a fox* is, if it is exemplified, possibly exemplified by something that does not have the property of *seeing foxly a dog*.

This modified explication of the adverbial theory allows us to apply the theory also to cognitive properties such as *thinking unicornically*, and to other intentional phenomena.

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BRUNO SCHUWEY

Aesthetic Qualities

The history of the problems raised by aesthetic qualities can be traced back to Democritus's (*c.* 469–*c.* 370 BC) distinction between primary and secondary qualities. Also Galileo, René Descartes, and Robert Boyle (1627–91) anticipated the later discussion on this subject.

The *locus classicus* of the contemporary discussion of this distinction is to be found in John Locke's *Essay Concerning Human Understanding*. Locke states the distinction in several ways, and pleads for it with different arguments. These passages have been the subject of widely different interpretations and the precise way to state the distinction is still controversial, though there is growing agreement that the distinction is basically sound.

The contemporary discussion of the nature of aesthetic qualities started with Frank Sibley's seminal essay "Aesthetic concepts" (*Philosophical Review*, 1959) which gave rise to a lively and intensive exchange of ideas which lasted for decades and concerned semantical and phenomenological as well as ontological issues. The participants in this debate include the authors listed in the bibliography below and many others.

As to what distinguishes aesthetic qualities from qualities of other kinds, the following characteristics, among others, have been proposed:

1. that aesthetic qualities are phenomenal, i.e. perceived or perceivable;
2. that aesthetic qualities are value-relevant, i.e. relevant as reasons for positive and negative judgements about the aesthetic (not artistic) value of objects;

and

3. that aesthetic qualities are tertiary or emergent, i.e. dependent on other (primary and secondary) qualities.

However, the precise interpretation of these conditions has been much discussed. This is true in particular of the dependence requirement 3. above.

The basic idea is this: that aesthetic qualities (like 'is unified') resemble secondary qualities (like 'is red') in that both are phenomenal. But they differ from secondary qualities in that they are value-relevant and tertiary. To say that a painting has a red spot in the lower left corner is not to say or suggest anything about the value of the painting; it is not relevant as ground for aesthetic praise or blame. Moreover, we can easily imagine two objects x and y which differ only in that one is red, the other not. But it is not possible for x and y to differ *only* in that one of them is unified, the other not. If there is this difference between x and y, there must also be other differences between them, concerning e.g. the way colours are spread on the canvas.

The Variety of Aesthetic Qualities. An important obstacle to progress in the discussion of the nature of aesthetic qualities has been the implicit or explicit assumption that these qualities form a homogeneous class. This assumption needs to be examined critically. It is important to recognize that within the class of qualities thus demarcated there is a variety of aesthetic qualities which cannot be analysed in quite the same way. Thus attempts have been made to distinguish between aesthetic qualities along a number of dimensions: simple, complex; internal, external; descriptive, evaluative; literal, metaphorical.

Some aesthetic qualities ('unified', 'balanced') behave like Gestalt qualities in that the parts of the work are related to each other in such a way that the work would look unified (or balanced, respectively) to anyone contemplating the work under standard conditions and noticing the relation between these parts. Other aesthetic qualities ('gay', 'melancholy') are perceived emotional qualities in objects, and still others ('comic', 'moving') are tied to the reactions of the beholders in a way that the previous ones are not.

The Existence of Qualities in General. The statement that there are qualities of a certain kind can be interpreted in several ways. To say that there are qualities of a certain sort – Q's – can be to say or imply that statements like 'x is Q' are meaningful, or can have truth-value, or that we can distinguish between objects that have Q and those that do not, or that there are methods by means of which

such discriminations can, on the whole, be made.

More important than a general discussion about conditions for existence of qualities is probably whether there are rational methods, or generally accepted methods, in disciplines like art history, by means of which it is possible for art historians and critics to settle conflicting claims concerning aesthetic attributions in particular cases. Such methods are based on some of the pro arguments below.

A number of arguments have been raised for and against the existence and objectivity of aesthetic qualities. (See Hermerén 1988.) The most important arguments against the existence and objectivity of aesthetic qualities are probably various versions of the arguments of variation and simplicity. According to the former, aesthetic attributions vary with individuals, time, upbringing, culture, etc. Since there is no unprejudiced way of deciding which of two incompatible qualities attributed to an object is indeed a quality of that object, aesthetic qualities are not qualities of objects. According to the latter there is no need to introduce aesthetic qualities when we want to describe, interpret, and explain works of art and our reactions to them; to assume the existence of aesthetic qualities introduces unnecessary complications.

The most important arguments for the existence and objectivity of aesthetic qualities are probably the causal, the phenomenological, and public language arguments. According to the core of the causal argument, aesthetic qualities are dependent qualities; if a work of art x has the aesthetic quality A, then it has A because of the presence of the quality B in x. There is, according to the phenomenological argument, no fundamental difference between our experiences of a line as red and as graceful; hence it would be arbitrary to say that in one case but not the other we are dealing with a quality. Finally, according to the public language argument, critical disagreement presupposes that the contested terms are mutually understood, and they are mutually understood only if critics agree on the general conditions of application of these terms – and these conditions define in principle the truth conditions (or the correctness conditions) of aesthetic attributions.

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GÖRAN HERMERÉN

Affect. See: Emotion, Affect; Passive Affection

Albert the Great I: General Metaphysics

Albert the Great was born around 1200 in Lauingen (Swabia) and died in 1280 in Cologne. He was a German philosopher, natural scientist, and theologian, beatified in 1622 by Gregory XV and canonized and declared Father of the Church in 1931. Albert is a prominent mediator, conveying especially Aristotelian and Arabic texts into the Latin of the Scholastics. Through his commentaries and interpretations he attempted to integrate the Augustinian and Platonizing theologies with Aristotelian philosophy and empirical natural science. Nevertheless, he held these departments of knowledge to be independent with regard to their fields and working methods.

Man rises in theology from the mystic experience of God's grace to comprehend the ground of belief. In metaphysics he rises from comprehending reality to comprehending God and hence discovering the real grounds for the existence and essence of nature. In the natural sciences he rises from observation and experiment to establishing scientific assertions. Theology has to clarify the relation between Creator and creation, which Albert defines in the sense of a negative theology that teaches what God is not, i.e. by

determining his dissimilarity from creation.

Metaphysics treats of being as such (*quodlibet ens*) according to its most general predicates: unity (*unum*), truth (*verum*), and goodness (*bonum*). Primarily metaphysics has to elucidate the unity and manifoldness of creation in order to establish a unified understanding of the world. The basis for this is Albert's trimodal realism, influenced by the Arabs (Alfarabi (*c.* 870–950) and Avicenna (*c.* 980–1037) according to which universals exist in a threefold way:

1. Before the thing (*ante rem*): this is the metaphysically 'supereminent' mode of existence, the existence of the general nature before its realization in any singular thing. The universals before the things are the principles of existing things (*formae principia rerum* or also *causa formalis*). They exist in God as '*ratio aeterna*'.
2. In the thing (*in re*): this is the concrete existence of the universal as *genus naturale* – the 'essentia', to which as such the '*esse in materia*' is accidental. The universal in this sense constitutes the complete quiddity or whatness of the singular thing in which it is realized.
3. After the thing (*post rem*): this is the abstract existence of the universal as *genus logicum* – the '*essentia*' received as concept into thinking in so far as it is related to, and constitutes the content of, a proposition about its '*suppositia*'.

The universal is form and is form for all: as forms before the things which realize them; as forms in the things, giving existence and the reason of those very things; and as forms after the things, separated in the intellect by abstraction.

In his treatment of change or development, Albert distinguishes between fluent form (*forma fluens*), a form which is to be conceived in itself as change or motion, and the flux of forms (*fluxus formae*), i.e. change or motion, which arises via a sequence of forms. The diversity of forms cannot be caused by matter, on which only the numerical multiplicity of individuals depends (*materia principium individuationis*).

Creation is founded on the trinitarian structure '*materia-compositio-forma*', the ontological status of which is examined by metaphysics while the *philosophia prima* examines its functions. Albert banished popular mythic ideas from science and pleaded for the idea that scientific statements should be established by demonstrative and natural knowledge. He had a great influence on Thomas Aquinas (1225–74), Ulric of Strasburg (*c.* 1248–77), and Dietrich of Freiberg (*c.* 1250–*c.* 1318/20), as well as on the manifold forms of Platonic philosophy of nature.

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GÜNTER SCHENK

Albert the Great II: Albert and Other Philosophers

Albertus Magnus (Friar Albert of Lauingen, O. P.; *c.* 1200–80) was hailed by the young scholars at the University of Paris in the 1260s as one who composed an entirely original metaphysics. This claim was ridiculed by representatives of the Oxford Franciscan School, especially by Roger Bacon. Nevertheless, just as Bacon and the Oxford Franciscans grafted a Neoplatonic metaphysics onto an Aristotelian ontology, so too did the school of German philosophy which owes its origins to Albert. The ontology and metaphysics of both schools gave rise to major differences which would have fateful consequences for the future of Western metaphysics and ontology. One major influence on the part of Albert was on the metaphysics and ontology of his most famous student, Thomas Aquinas.

Both Aquinas and Albert use the terms '*esse*' and '*ens*', 'Being' and 'a being'. Yet, major differences exist between the authors. Aquinas talks about 'Being' (*esse*) as act of existence, and puts great emphasis on the 'proper' autonomous being of created beings.

In Albert's account 'Being' is not the internal act of being by which things have their proper existence. For Albertus, to be is to be as essence. Scholars have emphasized the Neoplatonism of Albert's metaphysics, and note that there are echoes of the Neoplatonic doctrine of the One in Albert's metaphysics. Yet, in many places, Albert defends Aristotelian doctrines, as, for example, in his account of universals in *On predicables*.

The understanding of individuation in Albert is closely tied to his ontology of the person. Using the Boethian and Victorine (12th century) definitions of person, he stresses the notion that a person identifies something about a being which is non-communicable to another. The person is an individual substance of a rational nature. For Albert, an individual is that which has individuating accidents. The *res naturae* is a being complete in itself, a subject of accidents.

Universality for Albert is found in the *forma totius* (the total form) as distinct from the *forma partis* (the form of the part). In a composite of matter and form, the total form, the species, will include not just the matter but the form and matter. But in such a composite, it is the form of the whole which gives reality and essence, and which is disengaged from all individuating restrictions. Albert commonly speaks of the *species in hoc individuo particulari*. A consequence is that for Albert, what one knows in *scientia* (scientific knowledge) is not this individual, but the total form or species. Indeed, the species or form constitutes the whole being (*esse*) of individual things. Here, one has an ontological priority of species and essence over individuals.

Albert disclaims the appellation of Platonist, and attacks the mathematical Platonism of the Oxford Franciscans, the *amici Platonis*. Yet, his position inclines towards a strong realism which is a synthesis of Neoplatonic and Aristotelian elements. For like his contemporary Oxford Franciscans, he does subscribe to a Neoplatonic metaphysics of light.

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JEREMIAH M. G. HACKETT

Alexander of Aphrodisias

Alexander (fl. *c.* 2nd/3rd century AD) was appointed as teacher of Aristotelian philosophy, probably at Athens, between AD 198 and 209; little else is known about his life. His surviving works include commentaries on Aristotle, independent treatises, and collections of short discussions; of the latter two groups, some texts survive only in Arabic translation. Some of the short discussions may be by associates rather than by Alexander himself, and it is not always clear how far they represent his own consistent views. The *Metaphysics* commentary from Book VI onwards is probably by Michael of Ephesus; it is uncertain how far it incorporates genuine material. Alexander throughout sees himself as interpreting Aristotelian positions, but his interpretations have not always won general acceptance. In some cases he is developing discussions from the preceding century.

On the question of universals, Alexander holds that it is accidental to the object of a definition whether it is instantiated in one individual or many. Where there *are* several individuals of a type, however, the universal and common nature is prior to any *particular* individual; Socrates only exists because the common nature of Man does. Although Alexander regards universals as dependent on our minds for their existence, this should not be taken as indicating an extreme nominalism. Rather, individuals are *primarily* members of species; in recognizing their common natures our minds are not imposing arbitrary distinctions.

The human soul is the product of the mixture of the bodily elements, and hence is

mortal. There are three types of intellect. Each human being possesses material or potential intellect; this can develop into intellect ἐν ἕξει (*in habitu*) which contains abstracted forms and is capable of independent thought. Thirdly, the active intellect of Aristotle's *De Anima* 3.5 is identified by Alexander with the divine Unmoved Mover of *Metaphysics* XII. To explain how this acts to produce understanding, Alexander in his *De Anima* appeals to the principle that what has a property, here intelligibility, in the highest degree is the cause of that property in other things, and to the Unmoved Mover's being the cause of the existence of all other things. In an influential text of doubtful authenticity, *De Intellectu*, it is argued rather that our minds *first* apprehend the active intellect and are thus rendered capable of apprehending other things. Since God is pure form, and intellect becomes identical in form to what it thinks, our intellects can achieve immortality for as long as they think of the supreme intellect. In later writers the divine intellect when it comes to be in us was referred to as 'acquired intellect'; Alexander in *De Anima* uses this term rather for intellect ἐν ἕξει. He recognizes a plurality of transcendent, immaterial forms, to be identified with the Unmoved Movers of *Metaphysics* XII.8 rather than with forms of sublunary species.

Fate Alexander identifies with the natures of individual things, which determine what happens to them for the most part but not always. Providence is identified with the influence of the divine Unmoved Movers exercised through the motion of the heavens, which causes sublunary generation and hence preserves sublunary species; it is not concerned with the fortunes of individuals. Alexander rejects direct divine concern for the sublunary as beneath divine dignity; he tries to avoid making divine providence purely accidental, but it is not clear how the divine can have knowledge of the sublunary even in general terms.

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ROBERT W. SHARPLES

Alexander, Samuel

Samuel Alexander was born in Sydney, Australia, in 1859, and studied mathematics, classics, and philosophy at Balliol College, Oxford. He was the first Jew to be a fellow of an Oxford college (Lincoln). His thought at that time (cf. *Moral Order and Progress*, 1889) shows the influence of the prevalent idealism, as does a critical essay "Hegel's conception of nature" (*Mind*, 1886). He was, however, moving towards a metaphysics more closely related to empirical science and spent a period in the study of experimental psychology in Münsterberg's laboratory in Freiburg. From 1893 to 1924 he was professor of philosophy in the University of Manchester. He died in 1938.

Alexander's realist metaphysical system is set out in *Space, Time and Deity*; its associated epistemology is outlined in his British Academy lecture of 1914, "The basis of realism" (republished in Roderick M. Chisholm, ed., *Realism and the Background of Phenomenology*). Alexander recognizes that the world as experienced and as studied by the empirical scientist has certain partial and varying features. The proper concern of metaphysics, however, is with the comprehensive and unvarying features of the world, which he calls 'categorial' and '*a priori*'. They are *a priori* not, however, because they are 'prior to' or imposed upon experience, but because they can be found in reflective

description of its general character. One such category is that of *relation*, of which an instance is a *compresence* or togetherness of things. The relation of mind to its objects is a case of compresence.

Thus mind, for Alexander, is within and not beyond nature. The mind's awareness of an object compresent with itself is called 'contemplation'; its awareness of itself as being aware is called 'enjoyment'. Conscious awareness in these two modes is a special quality of certain natural complexes, and is called an *emergent quality*; that is, a quality whose existence is not deducible from our knowledge of the elements comprising the complexes. This is naturalism, but not materialism, since for Alexander mental qualities are not reducible to physical ones. Indeed, the character of physical matter is itself an emergent in complexes of that basic 'stuff' which is space-time. (Alexander drew on Hermann Minkowski (1864–1909) and H. A. Lorentz (1853–1928) for the notion of space-time as a four-dimensional continuum.) Space-time is ordered by reference to 'point-instants' from which perspectives can be developed.

Bertrand Russell, too (cf. his *Analysis of Matter*, 1927), was concurrently constructing a view of the material world as built up out of 'events' described via relations between points in space-time, notably 'compresence' and serial ordering in routes or lines. Alexander's material world is a system of *motions* in space-time, a point-instant being a limiting case of a motion. Motion is a primitive category, and not, as with Russell, to be treated as a compact series of positions. The category of substance is that of a persisting configuration of motions; that of cause the continuance of one configuration of motions into another, forming a process of which the cause is the earlier stage, and where there is change in acceleration or direction or both.

The temporal aspect of space-time is seen as making for a certain *nisus* or tendency in space-time for it to form a hierarchy of complexes displaying new emergent qualities. This suggests a teleology that surely calls for some property in space-time besides extension and duration. Mind is the highest emergent quality we know, but the *nisus* in space-time is carrying us towards the emergence of one yet higher, which Alexander calls 'Deity'. 'Deity' does not stand for a transcendent God, but for an as yet unrealized quality towards which the world is tending and to which we feel drawn in religious experience. There are certain realized qualities, notably truth and beauty, 'values' which Alexander calls 'tertiary', that arise in ways in which minds experience the world (cf. Alexander 1933).

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DOROTHY M. EMMET

Alfarabi. See: Arabic School

Al-Kindi. See: Arabic School

Analogy

The concept of analogy or proportion, a central concept in theories of religious language, has an ancient pedigree. For Plato the concept of analogy is primarily mathematical, connoting a ratio and expressible in mathematical terms, but he made use of it in ways which defy mathematical expression. In his *Timaeus* analogy acts as a principle for bringing the world's elements into harmony, and in *Republic* 7 knowledge is schematized in terms of a line which is divided into a set of proportionate divisions.

In the High Middle Ages the concept of analogy reached the centre of the philosophical stage. Doctrines of analogy were chiefly concerned to clarify the mode of signification of terms used to signify God's attributes. But these doctrines have not merely a linguistic but also a metaphysical aspect, a point Thomas Cajetan later stressed, for they seek to clarify the mode of being of

God as compared with that of created things, and to clarify it by reference to what is better known to us, namely creaturely being. Not all medievals held that God has being in a merely analogical sense. John Duns Scotus's doctrine of the univocity of being is sufficient witness to that fact. But Scotus's was a minority report. Most followed Thomas Aquinas's 'way of analogy'.

Aquinas's teaching was schematized by Cajetan in his *De analogia nominum* (Venice, 1506), in which he identified three forms of analogy.

1. *Analogy of inequality*, where different objects have a common name, and the notion indicated by the name is exactly the same but not shared to the same degree e.g. 'body' when used to signify a terrestrial body and a celestial body.
2. *Analogy of attribution*, where things have a common name, and the notion signified by this name is the same with respect to the object but different with respect to the relationships to the object; to use the stock Aristotelian example, 'healthy' said of physical exercise and of a healthy complexion, which are differently related to the health of the organism.
3. *Analogy of proportionality*, where things have a common name, and the notion expressed by this name is similar according to a given proportion; e.g. to see by corporeal vision and to see (= to understand) by intellectual vision.

This last type of analogy, which harks back to the Greek mathematical model, is based on the concept of an equality of proportions; i.e. $a:b = c:d$. Cajetan distinguishes two sorts of analogy of proportionality. First is that of metaphorical proportionality. I use 'smile' in such a way when I say that the meadow is smiling or fortune is smiling on me. Second is the analogy of proper proportionality, where the common name is predicated of both analogates without the use of metaphor; e.g. 'principle', as predicated of the heart with respect to an animal and of a foundation with respect to a house (Cajetan's example). This last sort of analogy is regarded by Cajetan as the one centrally at issue in Aquinas's writings. Whether Cajetan is right in this assessment is a matter for dispute. In any case there was no dispute that Aquinas's doctrine (*Sum. Theol.* Pt. 1, q. 13, a. 5) held out the hope that human language was not a totally useless instrument for talking about God. We could not only express truths about God but could even have a glimmering of the signification of the true propositions. From a consideration of the created world we can gain concepts of God's attributes. The concepts are imperfect representations of the attributes. But though falling short, they do not fail entirely. Hence the *via negativa*, as implying agnosticism, fails. Likewise, the *via affirmativa*, as implying anthropomorphism, fails. The *via analogica*, based on the concept of imperfect representation, is a *via media* between these two unsuccessful ways.

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ALEXANDER BROADIE

Analytic Philosophy

The term 'analytic philosophy' is an inexact one, without a clear or standardly accepted signification. It may be used historically, to designate several strands within 20th-century philosophy, or loosely, to denote a broad stream in contemporary philosophy which is considered to be continuing the issues and ways of doing philosophy characteristic of these movements. A number of adjectives have been suggested as alternatives to the rather unsatisfactory 'analytic': 'exact philosophy' is perhaps the most promising, though it may suggest excessive mathematization. 'Scientific philosophy' is too redolent

in English of scientism, though the German equivalent *'wissenschaftliche Philosophie'* carries just the right connotations. 'Rigorous philosophy' recalls Edmund Husserl's philosophy as a rigorous science (*strenge Wissenschaft*). I shall review the historical movements within analytic philosophy before returning to consider what the term perhaps ought to signify.

Analytic Realism. It is common, if somewhat over-simplified, to consider analytic philosophy as beginning with the revolt of G. E. Moore and Bertrand Russell against the neo-Hegelian idealism which held sway in Britain in the late 19th century. Russell's somewhat self-serving dramatization of this change of opinion was reinforced in the analytic tradition by talk of a 'revolution in philosophy'. In fact the revolution consisted in the first place of nothing more than a rejection of idealism in favour of a robust realism. The methods and tone of the philosophy of Moore and Russell were initially not very different from those of the idealists F. H. Bradley and J. M. E. McTaggart, and their new doctrines brought them into proximity with other philosophers, above all with those, such as Alexius Meinong and Husserl in continental Europe, who had made their way independently to similar conclusions, or, somewhat later, with the New Realists (such as William Pepperell Montague, Walter T. Marvin, and Walter B. Pitkin) in America.

Distinctly novel methods however soon came to accompany the new realist doctrines: Moore's examination in *Principia Ethica* (1903) of the meaning of the term 'good' and his conclusion that it is indefinable and unanalysable puts analysis of word meanings at the basis of ethics. Analytic philosophy's preoccupation with meaning is not unique in philosophy, but it was novel to hold that all philosophical questions can be answered only after due consideration has been given to the meaning of the terms in which the questions are posed. It was Moore, with his painstaking dissections of the terms in which philosophical theses were posed, who set the tone for analytic philosophy. Moore's defence of common sense, set out in the 1920s but at work much earlier in his rejection of idealism, tended to deflate attempts at grand system building in the rationalist or German idealist manner. It was also Moore whose example established the short essay as the preferred medium of analytic philosophy, the implication being that philosophical problems can be tackled piecemeal.

Russell's contribution to analytic method arose out of his work in the foundations of mathematics and his attempts to resolve the paradoxes discovered there. His paper "On denoting" (*Mind*, 1905) embodies the view that philosophical problems can be solved by a proper analysis of sentences as a whole, inaugurating the method of paraphrase (previously advocated by Jeremy Bentham (1748–1832) but otherwise hardly used) as a powerful tool for disclosing misleading forms of words. The use of paraphrase presupposes that one can recognize when the correct form has been attained. This correct or *logical form* increasingly resembled the new logic which Russell, along with Gottlob Frege, Giuseppe Peano (1858–1932), A. N. Whitehead, and others, was creating, and led to the view that philosophy can best be served by use of a logical or ideal language whose grammatical structure, unlike that of everyday speech, mirrors its logical form. Russell described his own philosophy in 1911 as 'analytic realism'.

Logical Atomism. This term describes the kind of philosophy engaged in by Russell and Ludwig Wittgenstein from about 1912 to 1930. It is different from the earlier views of Moore and Russell (who in fact used the term 'logical atomism' in 1911) in doctrine rather than method. In logical atomism, analysis of language shows the world to be composed of independent items constituting a plurality of facts. Despite differences in doctrine and emphasis between Russell and Wittgenstein, both continue the idea of paraphrase of sentences about empirical reality into a logically perfect idiom. Now, however, the idea is that such a language mirrors the form of the world, which lends the notion of analysis an obvious ontological dimension. While Wittgenstein in his *Tractatus* relies on immediate insight rather than impartable method to arrive at his views (cf. the fore-

word), the book does contain pronouncements on method in philosophy: that it is an activity of criticism of language rather than a doctrine, that it shows the limits of language, and that metaphysics and nonsense arise from ignoring these limits. These views were influential in the next stage of development of analytic philosophy.

Logical Positivism. The idea of applying the emerging methods of logical analysis to issues in the philosophy of science arose predominantly in Vienna and Berlin. In Vienna, the heritage of Ernst Mach (1838–1916), Ludwig Boltzmann (1844–1906), Franz Brentano (1838–1917), and Alois Höfler (1853–1922) prepared the ground: informal interdisciplinary discussions that had taken place in Vienna before World War I were re-established there afterwards, and intensified when Moritz Schlick (1882–1936) came to Vienna in 1922. Schlick established the regular meetings of what came to be called the Vienna Circle. The circle was reinforced logically by the addition of Rudolf Carnap (1891–1970), who, with Schlick and Otto Neurath (1882–1945), formed the circle's most illustrious lights. There was a brief but intensive period of interaction with Wittgenstein at the end of the 1920s.

Under Neurath's driving influence, the circle came into the public eye and established contacts with other groups, notably the *Gesellschaft für empirische Philosophie* under Hans Reichenbach (1891–1953) in Berlin, together with whom the circle established the journal *Erkenntnis*, with Carnap and Reichenbach as editors. Another group with whom fruitful contacts arose was in Warsaw, where a distinctive brand of careful, logically guided and anti-irrationalist logical analysis had grown up. It is during this phase of its existence that analytic philosophy is most appropriately termed 'scientific philosophy'. The Vienna, Berlin, and Warsaw groups, aided by Carnap (now in Prague) and other sympathizers in Europe and America, organized in the 1930s a series of international conferences which promised to internationalize scientific philosophy.

Doctrinally the Vienna Circle is best remembered for the verification principle according to which a sentence which cannot in principle be verified is meaningless. This was used as a blunt weapon to smite bastions of prejudice, superstition, and irrationalism, and earned the logical positivists (or logical empiricists, as Reichenbach preferred to call them) the opprobrium of many philosophers entrenched in more traditional doctrines. The principle could not survive in its bald form, and would probably have been abandoned in any case, but the politically occasioned diaspora of scientific philosophers on the European continent lent its demise a more sudden and dramatic aspect.

Another influential view was that of Carnap according to which philosophical disputes are to be resolved by what we now call semantic ascent (the move from talking about things to talking about our talk about things), coupled with his tolerant pluralism according to which more than one language may be philosophically acceptable, a view which tended to be pushed aside by Neurath's insistence on the programme of physicalism. Doctrinally and temperamentally the logical empiricists were more diverse than one might gather from their publicity, which enabled their enemies to brand and condemn them *en bloc*. The pressure of events in Europe forced several, especially those of Jewish ancestry or politically leftish views, into exile abroad, while several of those remaining were to perish in Nazi death camps. The political ascendency of fascism and the murder of Schlick in 1936 ended organized activity. The surviving members of the movement took their interest and expertise elsewhere, notably to the United States and Britain, where analytic philosophy was already fairly well established, and where they could fit into philosophical life without much difficulty.

Wittgenstein and Ordinary Language Philosophy. On his return to Cambridge in 1929, Wittgenstein set about revising his philosophy, and eventually disowned most of the distinctive tenets of logical atomism. His later philosophy emphasizes the complexity and social embeddedness of ordinary language as distinct from the monolithic ideal of a logically perfect language. Nevertheless, Wittgenstein continued to see philosophy as arising through misuse of language, and the

task of the philosopher as a critique of such misuse. On attaining the correct overall picture of language, one will see that there are no genuine philosophical problems. Wittgenstein's later philosophy is largely a struggle against the pervasive 'bewitchment' of language, one applied by him especially to problems in the philosophy of mathematics and philosophy of mind. It embodies a complete rejection both in tone and content of the scientistic aspirations of the positivists, and for this reason has been less influential in the United States, where positivist views have maintained their vigour more than in Britain.

Wittgenstein's turn to ordinary language coincided with a similar tendency in Oxford, which had precedents in the philosophy of John Cook Wilson (1849–1915), and whose most notable representatives, Gilbert Ryle (1900–76) and John L. Austin (1911–60), began work in the 1930s but came to prominence after World War II. Ryle's emphasis on category mistakes and systematically misleading expressions fitted tolerably well into Wittgenstein's idea of philosophy as a struggle against the bewitchment of language, but Ryle wrote more systematically than Wittgenstein, attempting in *The Concept of Mind* to expose the myth of "the ghost in the machine".

Austin's view of language was different, and was influenced by his training in classics. For Austin, ordinary language is a vast repository of folk wisdom embodied in fine semantic distinctions, and he marshalled his contemporaries to investigate the phenomena of language as a preliminary to an assault on genuine philosophical problems. Unlike Wittgenstein, Austin was prepared to propound philosophical theories, the one for which he is most remembered being the theory of speech acts. On his early death in 1960, Oxford ordinary language philosophy lost its leader and to some extent its direction.

Metaphysics and Mind. Metaphysics, which had been under a cloud since the 1920s, emerged again as a respectable study as it became clear in the 1950s that the positivist attempts to expunge metaphysics were inadequate. The key figure in this rehabilitation was Willard Van Orman Quine (born 1908), who, in his "Two dogmas of empiricism" (1951), criticized the sharp Humean analytic/synthetic distinction which the positivists had employed as part of their argument against metaphysics. He rejected also the phenomenalist reduction of statements about the real world to what is given in immediate experience. Despite this, Quine remained a philosopher in the mould of Russell and Carnap, thus a philosopher of science, employing logical methods, careful of language but no slave to idiom. His specific doctrines, such as the indeterminacy of translation, the rejection of modality, and the inscrutability of reference, excited more comment than they commanded assent, but Quine remains the outstanding figure of later analytic philosophy none the less. A parallel reacceptance of metaphysics, showing greater continuity with traditional (especially Kantian) views and with Oxford concerns, is found in the work of Peter F. Strawson (born 1919).

Informal and unsystematic analyses of language and meaning were hallmarks of much earlier analytic philosophy. In the 1960s these were increasingly replaced by more formal accounts of language. On the one hand, especially under the influence of Noam Chomsky (born 1928), the development of systematic and professionalized studies by linguists tended to divest philosophers of an area of research in which they had hitherto enjoyed free rein. Chomsky's avowed psychologism in linguistics and his emphasis on formal methods placed him at the opposite pole from ordinary language philosophy, and opened up the way to fruitful co-operation between linguists and logically inclined philosophers. On the other hand, and in explicit opposition to Chomsky, Carnap's student Richard Montague (1930–71) propounded the view that there is no radical difference in kind between ideal and natural languages, and applied the mathematical methods of formal semantics to natural languages.

The renewed relevance of issues of mind and psychology for philosophy of language was a contributory factor in a second tendency in later analytic philosophy: a shift in

emphasis from philosophy of language to philosophy of mind as the central area. The influence of Wittgenstein, the rise of cognitive psychology, and most particularly the issues of computers and artificial intelligence have also contributed to this shift in emphasis. The issues arising are demonstrably akin to those found in earlier Continental traditions of psychology, and make the 'revolution in philosophy' seem retrospectively less radical than had at first been thought.

Dominance, Diversity and Disillusion. By the 1960s philosophers who could describe themselves as analytic formed the majority of professional teachers in the English-speaking countries and in Scandinavia. Their numerical predominance coincided with the explosive expansion of university teaching and the professionalization and increased specialization of philosophy. One result was an increasing diversification of interests, no one of which was dominant, in contrast to what had been the case in analytic philosophy's earlier phases. One reason was that the monolithic status of the logic established by Frege and Russell, now termed 'classical', had been successfully challenged by a variety of different logics, most notably modal logic. Given a plethora of logics, it is no longer clear what is to count as *the* logical form of a sentence. It gradually became clear that there is no Archimedian point on which to turn philosophical arguments, so that considerations of language, mind, logic, science, and ontology have to be tackled together, rather than being broken down into neatly isolated puzzles.

The numerical predominance of analytic philosophers in the English-speaking world, together with the increasing diversity of issues in analytic philosophy, has resulted in many cases in a sense of tiredness and loss of overall direction which contrasts with the fresher and more combative phases earlier in the century, a feeling highlighted by a renewed awareness of these phases brought about by increased study of the history of analytic philosophy. Some analytic philosophers have turned for inspiration to movements and thinkers clearly outside analytic philosophy, such as F. W. Nietzsche (1844–1900) or Martin Heidegger (1889–1976), a move incomprehensible to those brave philosophers still trying to establish the credentials of analytic methods in parts of the world where they are still unwanted or of marginal importance. One reaction to frequent criticisms of analytic philosophy's sterility and remoteness from real concerns has been a turn of analytic ethics away from meta-ethical disputes towards applications to concrete ethical and social issues. Similarly, the standard teaching of logic has moved in many cases from imparting rudiments of modern mathematical logic to the critical study of the kinds of arguments actually used in everyday life.

What is Analytic Philosophy? In view of developments since 1960, it has become increasingly difficult to give a substantive answer to the question of what analytic philosophy precisely is. The lack of serious opposition but also of a dominant direction among the many thousands of philosophers trained in the analytic style means that the question tends not to arise for them, and the term is often used as a pejorative label by (indiscriminating) opponents. Typical characteristics of most analytic philosophy will include the primacy accorded to rational, intersubjectively assessable argument and criticism, the abundant use of examples, a tendency to sobriety and common sense, a distaste for system building, the approach to philosophy by problems rather than through its history, and some kind of central role for language in philosophical method. Historically, these characteristics fail to isolate analytic philosophy from forebears such as Aristotle, the Scholastics, or John Locke, or from later philosophers not reckoned analytic, such as Brentano. While the listed virtues are timeless, it is hard to claim an analytic monopoly for them, so it turns out to be easier to say what analytic philosophy was than what it is.

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PETER M. SIMONS

Analytic/Synthetic

This distinction, which is closely connected with the oppositions *a priori/a posteriori* and necessary/contingent, applies to sentences, statements, judgements, or propositions. The distinction was explicitly stated by Kant in his *Critique of Pure Reason*, and applied by him to judgements; related ideas concerned with the distinctions *a priori/a posteriori* and necessary/contingent had earlier been developed by John Locke, David Hume, Leibniz, Christian August Crusius, and others. For Kant, as for Aristotle, the structure '*S* is *P*' is the general form of judgement. A judgement *X* is an analytic judgement if and only if its predicate *P* is 'contained' in its subject *S*; otherwise *X* is synthetic. For instance, the judgement 'all bodies are extended' is analytic.

It follows from Kant's definition of analyticity that negations of analytic judgements are self-contradictory. Analytic judgements are uninformative (tautologous); they merely *analyse* the relevant subject concept. Formal logic for Kant consists of analytic judgements. Synthetic judgements, on the other hand, provide a synthesis of two concepts and are thereby informative. All analytic judgements are for Kant by definition *a priori*; synthetic judgements can be either *a priori* or *a posteriori*. The celebrated problem of Kant's philosophy concerned the possibility of synthetic *a priori* judgements; Kant was entirely convinced about the existence of such judgements.

Even if we neglect the extremely controversial problem of the existence of synthetic *a priori* judgements, Kant's account is defective and unclear in several respects. First, his definition is evidently too weak, since it has no application to sentential or propositional structures different from '*S* is *P*'. Second, he leaves unclear how we are to define analytic or synthetic falsehood. Third, the 'inclusion' of *P* in *S* is nowhere precisely defined. Fourth, Kant's language is burdened, in ways probably contrary to his own intentions, by psychologism.

After Kant, there appeared various purportedly improved definitions of analyticity (see Mates 1951). The following are the most important:

1. *X* is analytic (analytically true) if and only if *X* is true in all possible worlds; this definition goes back to Leibniz; it was also accepted by C. I. Lewis (1883–1964) in his *Analysis of Knowledge and Valuation* (1946).
2. *X* is analytic if and only if *X* could not be false; a variant of (1), mentioned by W. V. O. Quine in his influential criticism of the distinction in "Two dogmas of empiricism" (1951).
3. *X* is analytic if and only if not-*X* is self-contradictory (P. F. Strawson, *Introduction to Logical Theory*, 1952).
4. *X* is analytic if and only if *X* is true by virtue of the meanings of the constituents of *X* and independently of the facts (a typical logical positivistic account, see for instance A. J. Ayer's *Language, Truth and Logic*, 1946).
5. *X* is analytic if and only if either *X* is logically true or *X* may be reduced to a logical truth by replacement of synonyms; this definition was anticipated to some extent by Bernard Bolzano in his *Wissenschaftslehre*.
6. *X* is analytic if and only if *X* may be proved by logic and definitions alone (Gottlob Frege, *Grundlagen der Arithmetik*, 1884); the difference between 5. and this definition consists in that the former uses the concept of logical truth but the latter that of provability.
7. *X* is analytic if and only if *X* is true under every state description (Rudolf Carnap, *Meaning and Necessity*, 1947).
8. *X* is analytic in a language *L* if and only if *X* is true in virtue of the semantical rules of *L* (Martin, 1959).

Quine claims in his "Two dogmas of empiricism" that the notions of necessity, possibility, contradiction, semantic rules, and especially synonymy, which are employed in

the explications of the distinction are unclear and themselves require explication. Quine argues that these explications are either circular (when the concept of analyticity is explicated with the help of necessity, possibility, contradiction, or semantic rules) or they commit us to Platonism with respect to meanings as abstract entities (when we try to employ the concept of synonymy). Quine admits that there is a difference between logical and factual truths but, like Tarski (1936) and White (1950), he regards it as a matter of degree; this view may be also attributed to Bolzano. This leads to the conclusion that the analytic/synthetic distinction, if it can be made at all, cannot be sharp. Further, Ajdukiewicz (1958) pointed out that the truth of analytic sentences (for example, '1 gram is the mass of $1\,m^3$ of water at 4°C') sometimes depends on existential presuppositions which require an experiential justification.

The distinction between analytic and synthetic sentences might be defended by pointing to the indispensability of an appeal to meanings in semantics (Grice and Strawson 1956). Another rejoinder to Quine's objections consists in the explicit relativization of the concept of analyticity to a fixed language *L*, as in Martin 1959.

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JAN WOLEŃSKI

Angel

The word 'angel' is derived from the Greek ἄγγελος which is itself taken from the Hebrew word for messenger. Our knowledge of angels comes from the Old and New Testaments. In earlier ages they were imagined as having incorporeal or vaporous bodies, but by the 13th century they were regarded as purely spiritual substances having no bodies at all. This more sophisticated way of thinking owes much to the pseudo-Dionysius, a 6th-century Neoplatonic writer. It reaches its culmination in the theology of St. Thomas Aquinas.

There is no metaphysical proof for the existence of such beings. The standard moral proof posited their creation as fitting since otherwise there would be too great a gap between God and man, and this would run counter to the presumption that God would wish to achieve a variety of degrees of perfection in creating the world, according to the principle referred to as 'the great chain of being'.

Whether or not angels exist, they constitute an interesting study for the metaphysician. For they are understood to be purely intellectual substantial beings. They are not perfectly simple, however, for each is a composition of essence and its act of existing. Furthermore, after some controversy in the 13th century, Aquinas argued that each angel has its own unique essence, being immaterial, and consequently having no matter to individuate it. Thus Michael is essentially different from Raphael as two species in the same genus.

Again, angels are considered to be moral creatures, having been infused with a knowledge of ideas proper to their position in the hierarchy of being, and enjoying a free will to act on such knowledge. They are judged to be located wherever they happen to be knowing or acting, and so are inferred to be able to move instantly from place to place.

Thomas Aquinas is referred to as the 'Angelic Doctor' in part because of the great consideration given to angels in his theological writings and the frequency with which he contrasts the abilities of angels and humans. Jacques Maritain accused René

Descartes of 'angelism', since he speaks of himself as "a substance whose whole essence or nature is to think". Angels, of course, are immortal, since once created they will always exist; but they are not eternal, since they were created and did not always exist. In medieval cosmology they were believed to have a role as 'intelligences' moving the heavenly bodies in Aristotelian physics. Except in religious circles they are, however, today largely forgotten.

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DESMOND J. FITZGERALD

Anselm of Canterbury

Anselm was born in Aosta, at that time in Burgundy, around 1033. He entered the abbey of Notre Dame at Bec in Normandy in 1059, becoming prior in 1063 in succession to Lanfranc, and abbot in 1078. In 1093 he again succeeded Lanfranc (d. 1089), as archbishop of Canterbury. He died in 1109, was canonized in 1163, and declared a doctor of the Church in 1720. Although best known for the ontological argument in his *Proslogion*, he wrote much philosophy besides. The *Monologion* shows strong Platonic and Augustinian elements. There Anselm argues from the existence of degrees of goodness to the existence of a single standard of goodness, through which all the relatively good things have their goodness, and which has its goodness in and of itself. Likewise, whatever is exists through something which is one and the same in everything which exists. Nothing exists through nothing, and if several things exist through themselves then there is a property, that of existing through oneself, through which each of these things exists. That one thing through which whatever is exists, must be identified with that good through which all good things derive their goodness. That one thing is God. This form of argument now receives little attention. However, the ontological argument is at present subject to lively debate.

In faith Anselm seeks understanding of what he has faith in. God is that than which nothing greater can be thought. God exists in the understanding, but if he only exists there then a being yet greater can be thought, namely, one existing in reality as well. This argument, which has received little support, is followed by another (the 'modal argument') which is more formidable. God exists so truly that it is not possible to think of him as not existing. If he can be thought of as not existing then something greater can be thought of, namely, something so great that it cannot be thought of as not existing. Thus God's existence is necessary existence. C. Hartshorne, who has done much to refocus attention on the ontological argument, has argued that Kant's criticism, to the effect that existence is not a predicate, misses the point. Even if contingent existence is not a predicate, it does not follow that this holds equally of necessary existence.

In addition to the two works so far mentioned, Anselm wrote two short dialogues, now much neglected, though of great philosophical importance. In the *De veritate* Anselm takes up an argument from the *Monologion*, where he argues that truth has neither beginning nor end; for this proposition, that something was going to be, never itself began to be true or was not true. Likewise it will never cease to be true that something will have been. But nothing can be true without truth, and therefore truth has neither beginning nor end. Even if truth had a beginning, then before that beginning it was true that there was no truth and even if truth has an end then after that cessation it will be true that there will be no truth. Hence truth must exist even before truth and even after truth, if there be such a before or after.

In the *De veritate* the 'pupil' enquires about the nature of this thing, truth, which is thus spoken of in the *Monologion*. The 'teacher' replies that truth is rightness perceptible by the mind alone. Since truth is rightness, and rightness seems the same as justice, the

nature of justice is investigated next. The discussion leads to the definition of 'justice' as "rightness of will maintained for its own sake".

The second dialogue, *De libero arbitrio*, deals with the nature of free choice. It rejects the view that it is the ability to sin and not to sin (for then God would lack free choice), and argues, instead, that it is the ability to maintain rightness of will for rightness's sake.

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ALEXANDER BROADIE

A Priori/A Posteriori

The history of this distinction goes back to Aristotle. The terms *a priori* and *a posteriori* (their literal meanings are 'from what is earlier' and 'from what is later') were introduced by the schoolmen; for Albert of Saxony (*c.* 1316–90) a proof (*demonstratio*) is *a priori* when it proceeds from causes to effects, and *a posteriori* when it goes in the reverse direction. An important step toward the modern view was made by Leibniz, for whom truths *a priori* are 'truths of reason' and truths *a posteriori* 'truths established by experience'. David Hume then distinguished 'relations of ideas', which are certain and established with reference to operations of thought only, and 'matters of fact', which are marked by the fact that contrary situations are conceivable.

Both Leibniz and Hume observed very close connections of aprioricity, necessity and certainty on the one hand as well as of aposteriority, contingency, and uncertainty on the other. It was Kant, however, who initiated the contemporary discussion. For Kant, *a posteriori* knowledge is derived from experience, where the validity of *a priori* knowledge is independent of any experiential base. Moreover, Kant linked the *a priori/a posteriori* distinction with his division of all judgements into analytic and synthetic. The combination of the two distinctions gives rise to four kinds of judgements (propositions, statements, sentences): analytic *a priori*, analytic *a posteriori*, synthetic *a priori* and synthetic *a posteriori*. Since, according to Kant, all analytic judgements are *a priori*, three kinds only remain.

A range of different epistemological standpoints can be defined with reference to this typology of propositions (see Ajdukiewicz 1978). Radical apriorism (Plato) admits as bearers of knowledge only *a priori* propositions which may be either analytic or synthetic *a priori*. Moderate apriorism (Kant, Edmund Husserl) admits all three kinds of propositions. Moderate aposteriorism (Hume, logical empiricism) admits only propositions which are analytic or synthetic *a posteriori*, and, finally, radical aposteriorism (John Stuart Mill) admits only synthetic *a posteriori* propositions. Radical apriorism seems today to have no surviving adherents.

One of the most important problems associated with the *a priori/a posteriori* distinction is Kant's celebrated question concerning the existence of synthetic *a priori* judgements. In Kant's view, such judgements are produced by aprioristic factors – namely time, space, and the categories – which are 'necessary conditions' of our cognitive processes. Although our knowledge of nature is variable in its experiential content, it necessarily locates objects of cognition in time and space. The latter are therefore universal forms of sensory experience. The intuition of time and space provides in turn the basis for synthetic *a priori* judgements of pure mathematics.

Kant specifies twelve categories which are arranged in four groups: the categories of quantity (for instance, unity), the categories of quality (for instance, reality), the categories of relation (for instance, cause), and the categories of modality (for instance, existence). The categories enable us to synthesize empirical data into 'principles of nature' and generate synthetic *a priori* judgements of theoretical natural science which, for Kant, is

modelled by Newtonian physics. Kant's view here was criticized in connection with the discovery of non-Euclidean geometries but a form of it was taken up again by L. E. J. Brouwer (1881–1966) and his followers in their work on intuitionistic foundations of mathematics.

Husserl proposed a different conception of the synthetic (material) *a priori* based on his account of simple essences and essential relations which, he claimed, are involved in all experience. We can, he held, move from our ordinary attitude to the world of everyday and scientific experience to a so-called eidetic attitude. The knowledge gained by the latter is not *a posteriori*, since it surpasses our sensory – ordinary as well as scientific – experience. But nor is it analytic, so that it must be both synthetic and *a priori*.

The existence of material synthetic *a priori* propositions in Husserl's sense is defended also by Adolf Reinach (1921). For Reinach there are propositions about colours – for instance 'no surface is both red and green' – which are synthetic *a priori*. Langford (1949) argues that geometrical propositions interpreted in terms of visual space are both synthetic and *a priori*. Copi (1947) considers formally undecidable sentences of arithmetic. They are not empirical and, thereby, not synthetic *a posteriori*. And they are not provable from analytic axioms by deductive means. Thus, they must be synthetic *a priori*. Hao Wang (1974) gives almost sixty examples which were discussed over the years as candidates for being synthetic *a priori*. Among Wang's examples are: 7+5=12; if a point *a* is between *b* and *c*, then *b* is not between *a* and *c*; existence is not an attribute; hyprocrisy is not red; I could not have been born fifteen years later; '*Frau*' is a German word; Cantor was the discoverer of Cantor's theorem; the principle of mathematical induction; there exists an infinite set; there is a past; the axioms of prudence, benevolence, and equity; every event has a cause; I see with my eyes; and what is done cannot be undone.

Many problems arise in connection with the *a priori/a posteriori* distinction (see Pap 1958). Must *a priori* propositions be necessary? Must *a posteriori* propositions be contingent? Are all *a priori* truths universal? An interesting approach to the last problem is that of Saul Kripke (1971). Consider a certain concrete wooden table *t*. We know by appeal to experience that (*A*) *t is made of wood.* Then we ask whether *t* could have been made of some other material, for instance ice. Kripke says that the answer to this question must be negative, because we have a very firm intuition that (*B*) *any table made of ice would not have been the wooden table t.* This answer, Kripke continues, is generated by reflection on *t* and is therefore *a priori*. So we have: (a) we know empirically that *A*; (b) we know that if *A*, then necessarily *B*. Hence (c), we know that necessarily *B*; (c) is obtained from (a) and (b) by the rule of detachment. Now (c) is a necessary truth about a certain particular object, namely the table *t*. So Kripke comes to the conclusion that (c) is an example of a necessary truth which is not universal. This conclusion is, however, controversial, since (c) may also be considered as a universal truth about all tables made of ice. So the issue is still open.

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Aquinas. See: Thomas Aquinas

Arabic School

The Arabic School of philosophers who have written on metaphysics comprises mainly Al-Kindi (died after 870), Alfarabi (died 950), Avicenna (980–1037), and Averroes (1126–98). Of these, only Al-Kindi was of Arab descent, Alfarabi being Turkish, Avicenna Persian, and Averroes Andalusian. All wrote in Arabic, however (though Avicenna also wrote in Persian), and, more importantly, all were *falasifa* (the Arabic for 'philosophers'). As such, they were proud members of a tradition which comprised one strand within the complex web of what has been called an 'Islamicate' civilization. Islam as a religion was but one strand in this culture, so that Muslim (or 'Arab') philosophers were able to pursue philosophical and scientific issues for their own sake. It would be inaccurate, however, to exaggerate the freedom of the political or religious atmosphere within which the *falasifa* worked, or to deny the religious associations and relevance of much of their work, particularly in metaphysics.

Kalâm. Broadly speaking, there are two main traditions to which the Muslim philosophers are sensitive, the philosophical tradition itself, from classical through Hellenistic thought; and a largely indigenous theological tradition, known in Arabic as *kalâm*. Its practitioners were called *mutakallimun*, and were theologians of Islam who differed from their Christian counterparts philosophically in having developed an atomistic physics with clear metaphysical implications.

For the *mutakallimun*, all objects in the world are composed of an atomic undifferentiated material core and a number of 'accidental' properties, the composite entity held together in each instant, or continuously created, solely by the will of God. Objects have no nature of their own, and there is no objective reason or cause for anything, the appearance of such being an illusion which God has also willed. Time as well as place is composed of discrete units, each instant being an occasion for God to manifest his will and power. The world is totally dependent upon God's presence, and totally without its own resources.

The disparity between God's being and that of all else is considered so great that nothing is held in common, even our language being inadequate to express the real nature of God's being. We are forced to accept equivocal language and indirect or negative predication when attempting to describe God, points made particularly by the *mu'tazila* branch of *kalâm*, that known for its relative rationalism. For the *mu'tazila*, the oneness of God's being is both absolutely simple and all encompassing, all divine attributes being understood as equal simply to the assertion that God exists.

Al-Kindi. Al-Kindi, the first to do philosophy in this Islamicate civilization, was fully familiar with *mu'tazila* theology, which enjoyed official sanction in his day in Baghdad. The ruling Abbasid caliphs were also responsive, however, to the translation and study of philosophical texts, with which Al-Kindi was involved. He is said to have 'corrected' Ibn Na'imah of Emesa's translation of the *Theology of Aristotle* (the abridgement of Plotinus's *Enneads*), and to have had Eustathius translate Aristotle's *Metaphysics* for him. Al-Kindi's own treatise *On First Philosophy* (Eng. trans. by A. L. Ivry, Albany, N.Y.: State University of New York Press, 1974) shows the influence of these two texts, which were the main influences on the metaphysics of his successors also.

For Al-Kindi, as for the *mutakallimun* and *falasifa* in general, God's uniqueness is a basic tenet, a concept which cannot be understood except in contrast to all else, and then only equivocally. No other being exhibits the essential simplicity of being which the One has; nothing else is truly independent and uncaused. Unlike the *mutakallimun*, however, Al-Kindi believes that objects have their own nature, however contingent it is, and it is a nature which can be explained along causal lines. Uniquely among the *falasifa*, Al-Kindi asserts that God created the world *ex nihilo*, but Al-Kindi's philosophical affinity shows through in his rejection of the *kalâm's* anti-causal occasionalism. Arguments derived from John Philoponus (fl. *c.* 529) are used to invalidate the concept of actual infinity, while the notion of potential infinity is dismissed out of hand.

The God of Al-Kindi resembles Plotinus's One, and it is the Plotinian notion of emanation which Al-Kindi evokes, however broadly, to explain God's action in the world. Al-Kindi ignores the Neoplatonic hypostases, however, and is more comfortable generally with Aristotle's *Metaphysics* than with the *Theology of Aristotle*, particularly favouring Aristotle's general discussion of being and not his more 'theological' teachings concerning the separate intellects and God.

Alfarabi. It is with Alfarabi in the 10th century, in Baghdad and Aleppo, that the particular kind of metaphysics sketched by Al-Kindi becomes better articulated. Though the sincerity of Alfarabi's commitment to metaphysics, and particularly to the doctrine of immortality, has long been suspect, his teachings influenced Avicenna and others. (Cf. *Al-Farabi on the Perfect State*, Eng. trans. by R. Walzer, Oxford: Clarendon Press, 1985.)

For Alfarabi, as for Al-Kindi, God is understood as a unique and incorporeal being, the first cause of the universe, himself uncaused and unaffected by all else. Once again, emanation is seen as the mechanism whereby God affects and orders the world, a world again understood in terms of Aristotelian principles of hylomorphism and causation.

The God of Alfarabi is not, however, totally other. He is more akin to the Aristotelian self-thinking intellect or νοῦς than to the Plotinian One, and as such his nature is somewhat replicated in the separate intelligences of the spheres. There are nine celestial bodies and ten intelligences arranged, following Ptolemy, in concentric circles. While God thinks himself, the separate intelligences think of God as well as themselves. This dual activity generates the planet or body of the sphere as well as the intelligence of the next lower sphere, all regarded as eternal. The actualization of one from the other is more an expression of efficient causality than it is of creation as normally understood, and similarly the term 'emanation' is used loosely to describe the activities occurring in the supernal realm.

For Alfarabi, God 'acts' in a passive way, as the object of intellection and affection, though in reality he knows and loves only himself. Starting with the celestial intelligences, the beings of this world look to God as their final and remote cause; in effect we project upon him the activity and sense of being affected which is experienced by all conscious beings.

The emanative scheme is employed more effectively at the point where supralunar and sublunar bodies interact, the former seen as influencing the composition of the latter. The tenth celestial intelligence, first identified as the Active Intellect by Alexander of Aphrodisias, is thought to actualize on earth both the potential intelligibility of an object and the potential intellect of a person, which intellect is regarded by Alfarabi as a disposition to think abstractly. The acquisition of abstract truths is the last stage of a cognitive process which starts with sensation and progresses to the imaginative faculty and memory. Even the intellect of the prophet undergoes this process, so that the prophet is a philosopher, his revelation a popular expression of abstract universal truth.

It is the Active Intellect with which contact is made by the person who perfects his intellect, though a permanent conjunction of intellects is not envisioned. Alfarabi speaks of an after-life for the soul in proportion to intellectual achievement, and he may have believed in some augmented collective immortality, shared by those who held the same truths.

Avicenna. Avicenna is more explicit about individual immortality, and for him more than the intellectual faculty of the soul endures, since the soul is initially a separate substance, part of a universe in which individual immaterial substances abound. Acknowledging his debt in metaphysics to Alfarabi, Avicenna treats the subject in greater detail and scope than his predecessor, and with more of a Platonic orientation (cf. *Avicenne: La Métaphysique du Shifa'*, 2 vols., Fr. trans. by G. Anawati, Paris: J. Vrin, 1978). He develops the notion of intuition to explain revelation and prophecy, since intuition allows one to bypass the middle terms of a syllogism and immediately grasp the truth of a given proposition, allegedly without prior education or experi-

ence. Such truths come directly from the Active Intellect, which also directly informs the rational and imaginative faculties of exceptional individuals. Others must prepare themselves for the insights they receive, though when ready, their intellects are also illuminated directly by the Active Intellect (cf. *Avicenna's Psychology*, Eng. trans. by F. Rahman, London: Oxford University Press, 1952).

After death, our souls become one of the eternal substances, capable for Avicenna of experiencing pleasure or pain, and of change. This personal note appears also in his theory of providence, according to which the souls of the spheres have knowledge of particular events through their sensory and imaginative faculties. This knowledge is the awareness of the effect which the planet will have on earth below, given its predictable motion. The individual who knows the movements of the spheres can thus know the future, though Avicenna acknowledges that conflicting celestial motions can change things, preventing in effect a completely predetermined future. Matter too is unpredictable to a degree, being capable of change, and hence it is identified with privation and evil.

In a formulation of God's nature which was to become popular in Jewish and Christian as well as Muslim circles, Avicenna developed the concept of the deity as a necessary existent, while all other beings were merely possible existents, deriving their existence and necessity from God. The beings of the world were thus possible *per se*, and necessary *per aliud*, only God being necessary *per se*, his essence being existence. Avicenna thus presented a world theoretically contingent yet actually necessary; a paradox compatible, he believed, with the strictures of Islam and philosophy.

The *de facto* autonomy of nature is evident in Avicenna's elaboration of the emanation model taken over from Alfarabi. Each of the nine celestial intelligences is now thought to generate the intelligence of the adjacent lower sphere by thinking of the Necessary Existent, and to generate both the matter of its sphere (by thinking of itself as an existent possible *per se*), and the soul of its sphere (by thinking of itself as necessary *per aliud*). Matter is thus the expression of possible existence, alien as such to God. The world is known to God through his self-knowledge, all essences being subsumed within the simplicity of his being.

Averroes. Averroes, in Almohad Spain, is not just at the geographical extreme from Avicenna in the eastern reaches of Persia, he is also at opposite poles philosophically. Known as 'The Commentator' for his extensive labour on Aristotle's works, Averroes attempted to refute the Platonizing tendencies of Avicenna, and the anti-philosophical attacks of the *mutakallimun*, with a rigorous Aristotelianism (cf. *Averroes' Tahafut al-Tahafut (The Incoherence of the Incoherence)*, Eng. trans. by S. Van Den Bergh, London: Luzac and Company, 1969).

Against Algazel's *Kalam* occasionalism, Averroes insisted on the necessity of causal explanation, and against Avicenna's essentialism he argued for hylomorphism. Existence cannot be separated ontologically from the essential being of an object, the possible existence of a thing unable to coexist simultaneously with its necessary existence. Potential existence for Averroes does not imply the radical contingency of all of nature *vis-à-vis* the one necessary existent, and God's relation to the world is once again seen in terms primarily of self-thinking intellect and first mover. The intelligences of the spheres function only in relation to their matter, and have no particular knowledge of events on earth. Man's intellect is derived from the Active Intellect and returns to it after death, and personal immortality is not to be had.

Thinkers after Averroes in the Islamic world turned from metaphysics to a mysticism influenced by Avicennian thought. The type of impersonal and scientific metaphysics Averroes advocated did not find a receptive audience in the more conservative climate that came to envelop Islam in the late Middle Ages, and Averroes's influence was much greater in Europe.

FURTHER READING

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Aristotelianism

Aristotelian philosophy is set off from other ancient philosophies by several characteristics. First, Aristotelian philosophy sought to provide an open encyclopaedia of the sciences and rejected Platonic and Stoic ideas of knowledge as a closed system. Second, the aims of the Aristotelian philosopher were modest. Because the individual sciences deal only with portions of the knowable, the philosopher works as a member of a team in a co-operative enterprise. Third, Aristotelian philosophy was done for its own sake and made no claim that its teaching led to salvation. Because Aristotle's doctrine was not thought of as being legitimated by a certain style of life, commentators on his works generally made little use of allegorical interpretation in order to uncover a secret meaning behind the text.

In the course of time, however, contacts with other traditions gave rise to a particular form of Aristotelian philosophy which may be designated as 'Aristotelianism' in a strict sense. This form of Aristotelian philosophy stressed the theoretical sciences in the encyclopaedia rather than the practical sciences which seek appropriate means to an end to be gained by action. Within the theoretical disciplines Aristotelianism stressed the systematic presentation of knowledge derived from principles already discovered rather than the continuing, inductive search for the principles of the deductive presentation. Finally, Aristotelianism stressed the hierarchy of the theoretical sciences and the ultimate principles of reality which Aristotle was assumed to have found rather than the principles which are proper to the individual sciences and make them in Aristotle's own conception autonomous.

Greek Aristotelianism. The older representatives of the Peripatos or Lyceum continued the school's tradition of team-work in the search for concrete data, tending towards empirical researches in the natural sciences, practical considerations in psychology and ethics, and historical studies concerning literature and political institutions. But around the beginning of the Christian era the encyclopaedic side of Peripatetic philosophy became increasingly important as a result of the great rebirth of scientific activity which took place in the ancient world. The great advances which were made in mathematics, astronomy, geography, zoology, and medicine demanded a new systematization of the theoretical sciences. In this context important thinkers – like Ptolemy (*c.* 90–168) and Galen (*c.* 130–*c.* 201) – adopted not only particular points of Aristotle's doctrine, but above all his idea of method and his conception of the unity of the sciences. The edition of Aristotle's works made by Andronicus of Rhodes (fl. *c.* 70–*c.* 50 BC) established Aristotle's idea of science as the knowledge of a comprehensive, structured body of demonstrated conclusions. The works of Alexander of Aphrodisias (fl. *c.* 193–217), the first great commentator on Aristotle, complemented this view of the Master's scientific corpus.

In the course of the 3rd century, however, the range of the problems with which philosophers were confronted changed profoundly. The success of Christianity forced pagan writers to come to the defence of the ancient gods and to revive the idea of philosophy as a way of life. Making use not only of many Platonic ideas, but also of Aristotle's theory of intellect, Plotinus (*c.* 205–*c.* 270) initiated a new exploration of man's interior life. His lead was followed in the 4th century in the philosophical schools of Syria, Pergamum, and Athens.

Since this Neoplatonic movement also stressed the coherence and continuity of Greek philosophy, many writers attempted to harmonize the thought of Plato and Aristotle as the two great representatives of the tradition. Plotinus's immediate pupil, Porphyry, took the decisive steps in this direction. In his interpretation Plato and Aristotle both contributed to the idea of philosophy as a way of salvation. The apparent disharmony between them derives from the fact that Aristotle began with sense-data and physics;

whereas Plato started higher, with the mind of man, and went further in divine matters. In his *Isagoge* to the categories Porphyry sought to interpret Aristotle's logic in such a way that it would be open to the higher realm of the intelligible. At the same time, the logic was expanded by Neoplatonist authors to include Aristotle's *Rhetoric* and *Poetics*. Simplicius (fl. *c.* 530), the school's last great representative at Athens, was able thus to regard poetic, rhetorical, and dialectical argumentation as degrees of participation in an ideal of absolute demonstration.

The Neoplatonic tradition of commentary on Aristotle as an introduction to the higher wisdom of Plato was represented at Athens by two works which transformed Aristotle's encyclopaedia into an idealistic system. Proclus's *Elementatio physica* deals with change in the sublunary world on the basis of Aristotle's *Physics*. His *Elementatio theologica* then seeks to exhibit all forms of substance – gods, intelligences, and souls along with the lower grades of reality – as necessary consequences deriving from a single first principle. In Proclus's view the philosopher should present his conclusions in accordance with the geometric method. Euclid's geometry provided a model for arranging the conclusions in a descending order so that they form the 'elements' of a continuous chain. This 'synthetic' descent presupposes an 'analytic' ascent beyond all hypotheses to the principle of all things, the Platonic One. These considerations concerning method enabled Proclus (*c.* 410–85) to bring together three great representatives of the Greek tradition – Plato, Aristotle, and Euclid. But in so doing, he modified profoundly Aristotle's understanding of both science and metaphysics. By taking the One as his point of departure, Proclus broke with the most fundamental principle of Aristotelian science – the principle that all reasoning proceeds from pre-existing knowledge.

At Alexandria Proclus's synthesis found but little resonance. This school adopted a conciliatory attitude to Christianity. Following Ammonius Hermeae (fl. *c.* 500), Alexandrian exegesis of Aristotle's text was sober and philological. Paying much less attention to metaphysics than did the successors of Porphyry, the Alexandrians made important contributions to mathematical studies and natural philosophy. Some of them even contested various Aristotelian notions. John Philoponus (fl. *c.* 529) not only rejected Aristotle's conceptions of motion and a separate agent intellect, but also the Neoplatonic revision of Aristotle's theory of science. His demonstration in the *De aeternitate mundi* (composed in 529, the year in which the academy at Athens was closed) that celestial matter was not incorruptible rendered questionable the entire system which Proclus had constructed.

These Alexandrian developments determined, in large measure, the approach of later Greek thinkers to Aristotle's philosophy in the Byzantine world. With the abandonment of the attempt to harmonize Plato and Aristotle in the interest of paganism, both thinkers came to be regarded simply as one part of a long, secular tradition of Greek philosophical thinking. The interest of Christian theologians in Aristotle was for the most part limited to the parts of his logic which preceded the theory of the syllogism. Works like John Damascene's (*c.* 676–*c.* 754) *Summa* of Christian doctrine opened with a lexicon of the philosophical terms necessary for the formulation of Trinitarian and Christological teaching. Such lexica were based in the main on the terminology of Aristotle's *Categories* and Porphyry's introduction to it.

But in Byzantium the Aristotelian science which went along with the logic never found a real home. Greek Christians had spoken of their attitudes to human existence as 'our philosophy', opposing it to the pagan way of life, the 'worldly philosophy of the Hellenes'. In accordance with this attitude, Byzantine monasticism had little interest in Aristotle's natural philosophy and metaphysics, even after it had been dissociated from paganism. With the renewed interest in scientific knowledge which appeared in the urban schools of the 10th century, attempts were made to rehabilitate 'Hellenic philosophy' and to bring it into agreement with Christian teaching. But the Aristotelian philosophy of men like Michael Psellus (1018–*c.*1078), which might have made the school of Constantinople a predecessor of the Latin universities,

was condemned by the Church authorities, who saw heresies originating in the attempt to apply the syllogism to dogma. It was only after the fall of Constantinople to the Crusaders that the necessity of responding to the challenge of an increasingly sophisticated Latin theology led to the composition of compendia of Aristotelian doctrine, although the debate regarding Aristotelian methods of proof continued. Leading theologians, like Gregory Palamas (1296–1359), denied the value of demonstrative and dialectical conclusions in theology, while the strictly orthodox opposed all learning.

Arabic Aristotelianism. In Islam Aristotle made his appearance as early as the second half of the 8th century. The interest in Greek medicine was the door through which he entered. The Arabic reception of Aristotle took place as a part of the reception of the Greek scientific encyclopaedia. Aristotle's division of the sciences supplied the structure for the encyclopaedia in which classical authors like Euclid and Ptolemy, Hippocrates and Galen also found a place.

The first Arabic translations of Aristotle were based on the Syriac versions of the works on logic made for theological use. But with the newly awakened interest in Greek scientific and medical works in the 9th century and the foundation of the *bayt al-ḥikma* at Baghdad by the Abbasid caliph, al-Ma'mûn (786–833), practically the entire remaining corpus (the exceptions being the *Eudemian Ethics*, the *Magna moralia*, and the *Politics*) was made available, together with the Greek commentators. A great number of spurious works was also translated. This Baghdad corpus of translations, made for the most part from the Greek originals, provided a unified basis for Muslim Aristotelianism from Persia to Spain.

By the 10th century a tradition of study of this corpus was well established in Baghdad. It was at first represented both by Muslim philosophers and by Christian Arabic writers who understood Aristotle as a dogmatic philosopher, the author of a closed system, in accordance with Neoplatonic ideas. Because this system was thought to agree with Plato in all essentials, excerpts from Plotinus and Proclus could circulate as the *Theology of Aristotle*.

In their commentaries on this corpus, Arabic philosophers tended from the outset to group the individual works of Aristotle together and comment on the logic, metaphysics, and natural philosophy as parts of a philosophical encyclopaedia. Since the philosophers thought of Aristotle's works as propaedeutic to the study of medicine, very few commentaries on the practical philosophy were written. And since they were less dependent on Athenian speculation than on the Alexandrian criticism which had served to some extent to free Aristotle from the Neoplatonic association with paganism, Muslim philosophers at Baghdad were much more able than the Byzantines to understand Aristotle's encyclopaedia as the value-free science which he himself had envisaged.

But this abstract science was never completely integrated into Muslim life. The encyclopaedists and bibliographers who were not strict philosophers divided the sciences in a way which respected the Muslim attitude. Alongside the 'Greek or rational sciences' associated with Aristotle's name they grouped studies concerned with the Muslim way of life which they called the 'Arabic or traditional sciences'. These latter sciences included the study of the Koran and the Muslim traditions, jurisprudence (*fiqh*) and dialectical theology (*kalâm*), along with Arabic grammar and philology, history, and literature. Philosophy remained the secular occupation of an intellectual élite, of interest for medical studies, but of little significance for the religious life of the Muslim.

Some attempts were made, however, to harmonize Muslim belief with Aristotelian philosophy. One of the earliest of these attempts involved changes in the Aristotelian theory of science in the direction which Proclus had indicated. The *Book on the Pure Good* – better known under its Latin title as the *Liber de causis* (*c.* 9th century) – was ascribed to Aristotle both in the Arabic and later in the Latin tradition. The thirty-one propositions of this work unfold the structure of the entire universe. The first proposition lays the foundation for the whole tract: a higher cause has more influence than an inferior one because it causes the very causality of all the inferior causes. From this first

principle the work derives first the three orders of spiritual substance, the first cause, intelligences, and souls, and then all the lower grades of reality.

The *Liber de causis* thus substituted a Creator for the Platonic One as the principle of the universe. Whereas Proclus had spoken of the outflowing of the universe from the One and its subsequent return to the source, the author of the *De causis* replaced the first moment with the revealed idea of creation. But this substitution did not change the concept of science on which Proclus's work is based. The *De causis* retained the method of the logical deduction of reality from a presuppositionless first principle. We have in the work to do with a concatenation of statements which resembles the *Elementatio theologica* in that no axioms or hypotheses are stated at the outset.

Although the *Liber de causis* remained without an echo in Islam, it represents an important side of the doctrinal crisis to which Muslim belief was subjected in the 9th and 10th centuries. Another side of the crisis was the appearance of the heresy of the Mu'tazilites. These adherents of Greek rationalism came, by way of the problem of predestination and God's justice, to the question of the relationship between God's attributes and his essence and thus to conclusions which were heretical from the standpoint of the Muslim tradition. The need to reply to this heresy gave rise to the social class of theologians in Islam. According to Muslim teaching, the faithful were obliged to strive to advance from simple belief to certitude with regard to the doctrines of the faith. The task of the theologians was to supply the faithful with logical proofs for their belief. *Kalâm* is for this reason essentially apologetic in character. The methods of proof of the theologians were generally quite primitive, but they forced the Aristotelian philosophers to refine their idea of scientific methodology. They did this by returning to Simplicius's distinction of sophistical, rhetorical, dialectical, and strict demonstration.

Alfarabi (*c.* 870–950) in his *Catalogue of the Sciences* attempts to fit 'the traditional sciences of the Arabs' into the Aristotelian division. The *Catalogue* treats the sciences of language, logic, mathematics, physics and metaphysics, and politics with *fiqh* and *kalâm*. Whereas the doctrine of God is subsumed under metaphysics, *kalâm* is regarded as a practical science with the function of defending the articles of faith. Alfarabi recounts that in pursuing this task the theologians made use of rhetorical arguments based on the miracles of the prophet or the supra-rational character of the articles. They even resorted to sophistical arguments against the opponents' religion. In case of a conflict between revealed doctrine and truths rationally established, they generally had recourse to allegorical interpretation of the texts. Important for the theory of science was the distinction made by Alfarabi, in treating of mathematics in the third part of the *Catalogue*, between the analytic and synthetic method. The synthetic presentation of a body of doctrine in accordance with Euclid's procedure was applied with great success in Arabic treatises like Alhazen's (*c.* 965–*c.* 1040) *Optics*.

About a century later, Avicenna (980–1037) envisaged a reform of the science of theology in accordance with the Aristotelian theory of a demonstrative science. An increasing preoccupation with theological questions led him to try to understand *kalâm* as metaphysics. Accordingly, he distinguished dialectical and rhetorical argumentation from demonstrative proof and enumerated the types of premiss which may be admitted in each of the various forms. If the doctrine of God is to be presented scientifically, it can use as its point of departure only axioms, sense-data, and the unanimous agreement of the Muslim tradition. Through Algazel (1058–1111), Avicenna's conception of logical proof was influential in Muslim theology.

Whereas Alfarabi and Avicenna were Persians, Averroes (1126–98) wrote in Muslim Spain where the theologians were if anything more reactionary than in the East. In confronting them as a philosopher, he also had recourse to the distinction between rhetorical, dialectical, and demonstrative argumentation. Rhetorical argumentation is adapted to the multitude of the faithful who should accept the Law literally. The dialectical arguments of the theologians yield only error; the miracles and mysteries of which they speak

are the perversion of religion and the result of the theologians' own ignorance. Only the demonstrative arguments of the philosophers provide certain truths. In those cases where demonstration leads to conclusions apparently in conflict with the Law, it is necessary to distinguish an exoteric meaning for the multitude and an esoteric meaning, intelligible only to the élite. Philosophy is the occupation of this intellectual élite, whose God-given task is the free pursuit of truth. By the 14th century, however, this élite had disappeared in Islam, along with its philosophical encyclopaedias.

Medieval Judaism also had need of Aristotelian science and the logic which went with it. In Spain and southern France, Hebrew translators made the Muslim corpus of Aristotle's works available, along with Averroes's commentaries and the medical works which accompanied them. Where conflicts between philosophy and the Jewish faith appeared, some thinkers – of whom Moses Maimonides (1135–1204) was the most important – held that philosophical speculation must proceed according to the theory of demonstrative science, without regard for theological doctrine. Only when the philosophical and theological doctrines have been clearly defined can one ask how the two realms are related. In spite of this view, an increasingly critical evaluation of Aristotle's doctrines in the light of the faith appeared in Judaism in the 14th century and contributed – even in the Latin world – to the development of a new scientific world-view.

Latin Aristotelianism: Scholasticism. The works of Aristotle were made available in the Latin West in three clearly distinguishable stages. The first stage opened in the 6th century with Boethius's (*c.* 480–*c.* 524) translations of Aristotle's treatises on logic. The second stage began in the 12th century with the gradual translation – at first from the Arabic and then from the Greek – of the entire corpus of Aristotle's works. In this 'scholastic' stage the attempt was made to bring together Latin theology and Aristotelian science, an effort which was strongly influenced by Islamic philosophy. The third and final stage in the evolution of Latin Aristotelianism began in the 15th century and concentrated rather on the original text of Aristotle's works and on dealing with the anomalies which were making the traditional conception of the encyclopaedia of the sciences increasingly untenable.

The first wave of translations broke on the late Roman world. This world knew little of Greek philosophy and science, and, apart from some rhetorical notions transmitted by Cicero (106–43 BC), very little of Aristotle. Boethius's translations of the *Organon* could have but little effect in the monastic life of the early Middle Ages, where the conception of language as a divine creation – directly opposed to Aristotle's theory – grounded a symbolic view of the world.

In the second stage, Aristotle's works were received as part of a vast effort to absorb the secular learning not only of ancient Greece, but also of contemporary Judaism and Islam. In the flourishing young towns of the western Mediterranean basin, scholars manifested increasing interest in the great works of Greek and Arabic science and in the Aristotelian encyclopaedia which provided the framework for them. But these new interests soon came into conflict in the schools of northern Europe, not only with monastic traditions in theology, but also with the attempt of some of the masters of the arts to find in Plato's *Timaeus* an understanding of physical reality which would agree with Genesis.

The attention of the masters was thus turned to the need for a concept of science which could embrace both revealed doctrine and philosophical learning. From about the middle of the 11th century the masters not only used the dialectical *sic-et-non* method to solve the problem of the discrepancies between authorities. They also slowly pieced together the original fabric of the entire *Organon* from hints in classical authors. Although Aristotle's treatises on argumentation were not available until the latter part of the 12th century, we find in Peter Abelard's (1079–1142) *Dialectica* not only tracts corresponding to Porphyry's *Isagoge* and Aristotle's *Categories* and *On Interpretation*, but also a theory of the syllogism drawn from Boethius, along with a treatment of dialectics and the fallacies based on Aristotle and Cicero.

Even the outlines of the theory of science which Aristotle developed in the *Posterior Analytics* were worked out by 12th-century authors. In the search for models for the ever more pressing problem of the systematic presentation of doctrine, the masters were guided at first by Boethius and then by Euclid. Boethius had understood science in the Aristotelian sense of doctrine which takes its departure from first principles and proceeds by strict demonstration. The fact that he described the method employed in his *De hebdomadibus* as that of 'mathematics and the other sciences' led early authors to try to develop a general theory of scientific method from it. Gilbert of Poitiers (*c.* 1075–1154) maintained, for example, that first principles can be established for all the liberal arts and in the same way for theology itself.

Euclid's axiomatic method offered a still better model for the systematic presentation of a traditional body of knowledge and efforts were made by authors like Nicholas of Amiens (fl. *c.* 1190) to develop theological doctrine accordingly. But about the beginning of the 13th century a number of theological works appeared in which this method was modified in the Platonic direction indicated by Proclus. The most important of these treatises was the *Regulae caelestis iuris* of Alain of Lille (died *c.* 1203). In this work we have to do with a concatenation of interrelated statements which resembles geometry as a structured presentation of doctrine, but betrays its dependence on the *Liber de causis* in that nothing is presupposed at the beginning. The danger for Catholic theology which was implicit in this method was quickly recognized by the Church authorities. Alain's attempt to present theological teaching in a way in which nothing is presupposed made it seem that he was equivalently trying to prove the articles of faith.

In 1210 and 1215 Aristotle's *libri naturales* – including the *Metaphysics* and the *De causis* – were condemned at Paris. It would seem that these condemnations were aimed not only at specific points of doctrine, like that of the eternity of the world, but also at the Platonic conception of science found in the *Liber de causis*. The fact that these condemnations were for the most part observed during the period between 1215 and the final acceptance of the Aristotelian corpus at Paris in 1255 makes these forty years decisive for the formulation of the scholastic method, strictly so called.

Since Aristotle's logic was explicitly excluded from the condemnations, the masters of arts turned their attention increasingly to the theory of science elaborated in the *Posterior Analytics*. While they worked on the axiomatic presentation of the quadrivial sciences of geometry (including optics), astronomy, arithmetic, and music, the theologians sought to construct their science not on the basis of *regulae* like those of Alain of Lille, but rather on the articles of faith as unproved but certain axioms or postulates, evident through revelation.

Parallel to the effort to forge a new tool for the sciences ran an awakening interest in the *libri naturales*. The masters in the new urban schools of Europe learned from physicists and physicians in Sicily, southern France, and Toledo of the existence of completely new areas of knowledge, areas of which they knew only the names. The translators who responded to the resulting challenge added immensely to the sum of medieval knowledge: Euclid in geometry and optics, Ptolemy in astronomy and geography, Hippocrates and Galen in medicine, and above all the works of Aristotle, together with his Arabic commentators.

Characteristic of medieval scholasticism was the desire to bring this new material together with theological teachings and the traditional liberal arts into one comprehensive body of knowledge. Working in the tradition of the *concordia discordantium*, 13th-century teachers made the epoch-making decision not to try to separate – as the Byzantines and Muslims before them had done – their own religious disciplines from the profane sciences inherited from the ancients. They attempted rather to situate theological teaching within the Aristotelian classification of the sciences, as it was known through the works of Boethius and Alfarabi's *Catalogue*, and to present the whole scientifically in Aristotle's sense. In this way, a guide for students at Paris composed about 1230–40 attempted to situate the plan of

studies in the arts faculty within the context of a complete classification of the sciences. After distinguishing three branches of philosophy – rational, natural, and practical – the anonymous author related revealed theology not to metaphysics, but to practical philosophy, as Alfarabi had done.

In the course of the next century an enormous amount of progress was made in mathematics and the physical sciences. For this development the Aristotelian natural philosophy supplied the philosophical principles and the encyclopaedic structure. The newly translated commentaries of Averroes served to establish the position of Aristotle as 'il maestro di color che sanno' (Dante, *Inferno* IV 131). Within the structure provided by his works the West caught up with Islamic lands in the natural sciences and surpassed them in technological innovation. The progress which was made was not limited to natural science; it also extended to the Aristotelian practical philosophy, which had been relatively neglected in the Arabic tradition. New translations of the *Ethics* and *Politics* from the Greek gave rise to new views of man's destiny and to new secular conceptions about the state.

The foundation for all this progress was laid in the year 1255, when Aristotle's works were prescribed for the lectures in the Paris arts faculty. From this time on the Aristotelian corpus provided the structure for medieval university instruction in philosophy. One of the first to turn his attention to the complete Aristotelian encyclopaedia was Albert the Great (*c.* 1200–80). His paraphrases of all of the fundamental works in Aristotle's encyclopaedia prepared the way for the vast commentatory literature through which the Middle Ages assimilated Aristotelian science.

Both the theologians and the philosophers saw in Aristotle the 'maestro e duca de la ragione umana' (Dante, *Convivio* IV vi 8). For their part, the theologians sought to establish a *concordia* between Aristotle's conclusions and revealed doctrine. Such an agreement had become increasingly important with the expansion of Western Europe towards the East. The Latin faith had to be presented to Saracens and Jews, and to the pagan Mongols who had recently invaded the Near East. While Christian doctrines could not be proved, their acceptance was thought to be able to be shown at least reasonable, because congruent with basic philosophical conclusions, like the existence of God and the immortality of the human soul, which Aristotle was thought to have demonstrated.

In the view of Thomas Aquinas (1225–74), the explanation of theological doctrine had therefore to be in accord with Aristotle's theory of the speculative sciences. Through Aristotle's theory the theologians could maintain the scientific character of their discipline, while recognizing the autonomy of the philosophical sciences. Just as these sciences have their own principles, so also theology is the particular science which has the articles of faith as its proper principles. The Aristotelian metaphysics supplies the common principles for all the sciences and can thus guarantee those basic philosophical doctrines which support revealed doctrine. According to the metaphysical principle of contradiction philosophical doctrines which entail consequences contrary to revelation must be rejected.

But in spite of the efforts made by the theologians, philosophy and theology drifted, in the course of the later Middle Ages, further and further apart. Not only did the progress which had been made in natural science free philosophy from its traditional role as the handmaid of theology and give the professors in the arts faculties a new understanding of their scientific vocation. The fact that many of Aristotle's ideas – his determinism, his notion of the eternity of the world, his denial of God's power to create an extramundane void or a plurality of worlds – conflicted with Catholic doctrine also enabled the philosophers to free natural science from the view that Aristotle was the ultimate authority in philosophical questions.

In the year 1277 the bishop of Paris condemned 219 propositions, of which the majority represented Aristotelian positions. In accordance with the theologians' view of the system of the sciences, the philosophical propositions were condemned because they entailed consequences contrary to revealed

teaching. For this reason the condemnation had far-reaching effects on the development of both theology and philosophy in the later Middle Ages. The theologians were forced to abandon the idea of a *concordia discordantium* between Christian teaching and Aristotelian philosophy and to defend the very credibility of the Christian doctrines they wanted to employ as the principles of their science. The philosophers were helped by the fact that many of Aristotle's doctrines were in conflict with Christian teaching to reject the metaphysical assumptions which lay behind many of his positions, especially in astronomy.

In the light of the condemnation, John Duns Scotus (1265–1308) revised the view that Aristotle's metaphysics could serve as a propaedeutic to the study of revealed theology. Scotus's conception of the subject matter of the science of being amounted to a critique of Aristotle's theory of the speculative sciences. Aristotle had to take sense-knowledge as his point of departure and could therefore draw conclusions valid in the physical order only. But for Scotus the revelation of the existence of spiritual reality opened a new horizon for metaphysics. He maintained that the first object of the intellect is not sensible reality, but rather being as such. This new definition made it possible not only to study divinity as infinite being, but also corporeal reality in a metaphysical way, as the finite being which is subject to change (*ens mobile*), in contradistinction to the corporeal reality studied as subject to change (*corpus mobile*) by the Aristotelian physics.

Theological revisions of Aristotle's theory of the speculative sciences, like that of Scotus, made it possible for 14th-century philosophers to go beyond Aristotle in the physical sciences. Aided by the idea that the individual sciences are autonomous in their own realm, philosophers like John Buridan (*c.* 1295–*c.* 1358) were able to develop theories in physics – like that of the motion of projectiles – which were independent of Aristotle's treatment, while mathematicians like Nicole Oresme (*c.* 1320–82) turned to areas which Aristotle had neglected, like the theory of proportions and infinite series.

Renaissance Aristotelianisms. The Aristotelianism of the period 1450–1650 presents a picture which differs radically from the university philosophy of the Middle Ages. The revolt against scholasticism which took place during this period was basically part of a struggle between the old-established clerical class and new lay attitudes to philosophy. Scholastic Aristotelianism had offered a hierarchically unified world-view, but by the 16th century this unity had broken down, so that we must speak in this period not of one, but of several Aristotelianisms. At the same time, Aristotelianism became in the Renaissance but one among many philosophies. Whereas in the earlier period Aristotle had been 'the Philosopher' par excellence, from the mid-15th century other philosophies – Platonism, Stoicism, Epicureanism – began to claim attention.

This period was nourished by a third stage in the Latin reception of Aristotle's works. Encouraged by the Byzantine thinkers who brought to Italy an Aristotle unknown to the scholastics, Latin scholars in the different countries of Western Europe produced new editions of the Greek text, new Latin and vernacular translations and commentaries, Greek editions and Latin translations of practically the whole corpus of the ancient Greek commentaries, and Latin versions of hitherto untranslated commentaries of Averroes. It is an astonishing fact that the number of Latin commentaries on Aristotle composed during the century between Pietro Pomponazzi (1462–1525) and Galileo (1564–1642) exceeds that of the entire millennium from Boethius to Pomponazzi.

In the 16th century new classes of students and new scientific interests led various groups of scholars to attend to individual works of Aristotle without reference to his organization of science. In Italy humanist scholars turned to Aristotle's moral philosophy, literary critics to the teachings of the *Poetics*, professional philosophers in the universities to the natural philosophy and the biological works. In Protestant Germany Philipp Melanchthon (1497–1560) constructed a new, secular Aristotelianism for the schools which should serve the Reformation. In France and later in England the Ramist furore turned the attention of Aristotelians to

questions of methodology, while scholars concerned with constitutional reform returned to the Greek text of Aristotle's logic for new ways to interpret legal doctrine. Throughout Europe the *Politics* received renewed attention, quite without reference to the other parts of Aristotle's corpus.

These developments were for the most part alike in discarding the clerical Aristotle of the medieval schools. Ironically, the medievals themselves had begun the process. Thomas Aquinas's recognition of the Aristotelian view that the individual sciences have their own proper principles contributed to the gradual emancipation of the natural sciences from clerical control. As the sciences became increasingly independent, the Aristotelian classification of the sciences was itself rendered more and more questionable. It was no accident that secular thinkers of the Renaissance had little time for the metaphysical speculation of earlier centuries. Aristotle's science had never really fitted into the clerical mould which was formed by the medieval approach. In the Renaissance the Aristotelian spirit of pluralism and free research led to the disintegration of the hierarchical world-view of the Middle Ages.

The steps toward scientific pluralism were taken above all in Italy. Italian faculties of arts were orientated less towards theology than to medicine. Throughout the 16th century the Aristotelianism they taught was concerned primarily with the works of physical science and biology. But at the same time much attention was paid to the question of scientific methodology. Whereas the Aristotelian tradition since Proclus had concentrated on the deductive side of Aristotle's theory of science, Italian secular Aristotelianism rediscovered the equally Aristotelian method of induction. In Padua towards the end of the 16th century, Jacopo Zabarella (1533–89) distinguished clearly between the two moments, relating them to Aristotle's division of the theoretical and practical sciences. Whereas the theoretical sciences use a synthetic method in the presentation of doctrine deriving conclusions from first principles, the practical sciences employ an analytic method which takes its departure from the end of an action and seeks to discover the means and principles with which the end may be attained.

But the theologians did not give up without a struggle. The termination of the Council of Basel had marked the beginning of a new period in the history of the theological interpretation of Aristotelian science. The idea of a Christian Aristotelianism which had been adumbrated by Thomas Aquinas enabled the theologians to recognize the autonomy of the philosophical sciences, while continuing to maintain for apologetical purposes that Christian revelation and Aristotelian philosophy are basically in agreement. In this context the *Metaphysics* was increasingly commented on in conjunction with the *Physics* and *De Anima*, foreshadowing the later enumeration of metaphysical realities: God, the world, and the human soul. This new form of Aristotelianism developed primarily in the universities of northern Europe. But through the mendicant orders it was brought to Italy around the middle of the 15th century. The encounter of Christian Aristotelianism with its Italian secular counterpart resulted in the radical transformation of the Aristotelian speculative sciences.

The conflict broke out in 1516 with the publication of Pietro Pomponazzi's *Tractatus de immortalitate animae*. Pomponazzi maintained that according to Aristotle the doctrine of the soul belongs to physics as a part of the doctrine dealing with *corpus animatum*. Because it is a material form, it is corruptible. The attempts that were made – especially in the mendicant orders – to meet this challenge were based on the search for metaphysical rather than physical proofs for the soul's immortality. The Scotist definition of metaphysics as the science of uncreated and created being made it possible to consider the human soul and the world as metaphysical objects *sub ratione entis*. But this possibility implied in turn the necessity of a systematic reinterpretation of Aristotle's philosophy in accordance with what were regarded as its true principles, that is, such principles as lead to conclusions agreeing with Catholic doctrine. Benito Pereira (*c.* 1535–1610), professor in the Collegio Romano of the newly founded Jesuit Order, maintained that the doctrine of the soul belonged to metaphysics.

But because this science can treat incorporeal reality only as cause, he proposed a division of traditional metaphysics into two specifically distinct sciences: 'first philosophy', treating *ens inquantum ens*, and 'divine science', dealing with God, the intelligences, and the soul *per se*.

The project of rewriting Aristotle was also taken up in Iberian universities as a reaction against the growing autonomy of natural philosophy in the faculties of arts. The great systematic works of the Spanish scholastics on metaphysics attempted to present metaphysics *per modum doctrinae*, that is, as an organic whole derived from the first principles of philosophy. In his celebrated *Disputationes Metaphysicae*, the Jesuit Francisco Suárez (1548–1617) made the relationship of finite reality to the infinite, creative power of God the very foundation of his Christian reinterpretation of the Philosopher's thought. The God known through natural reason is the principle of a system which descends through the various divisions of finite being. Finite being is that which can be constituted in actual existence by God's absolute power, because its essence contains no contradictory notes.

Suárez's use of the distinction of reality into *ens infinitum*, *ens creatum immateriale*, and *ens creatum materiale* provided a metaphysical basis for the scholastic apologetics, met the increasing need for an independent treatment of the problem of God, and rendered the growing crisis of the Aristotelian physics as the science of *corpus mobile* irrelevant to scholastics. The distinction also implied the division of metaphysics into the parts which would later be called natural theology, rational psychology, and cosmology. In this form instruction in the speculative sciences was fixed for centuries, not only in Catholic schools, but also in Protestant academies and universities.

Despite Martin Luther's rejection of Aristotle and the scholastic mixture of philosophy and theology, the Aristotelian conception of science gained, within a century of the Reformer's disputation *Contra scholasticam theologiam* of 1517, a central place in Protestant universities – both in the schools which inclined to Calvinism and in the north German universities which tended to a strict Lutheranism.

In those territories which inclined to Calvinism, dogmatic theology was regarded – much as in Catholic Scholasticism – as a speculative science following a synthetic method. Reformed theology began with God as the first cause and proceeded by way of his eternal decrees to his supremacy in the world. Natural theology was thought to be an essential part of the *cognitio Dei perfecta* at which theology was aimed. Accordingly, reformed theologians distinguished with Pereira two metaphysical sciences, one dealing with God to the extent that he is accessible to human reason, the other a universal science of being which accounts for the principles of all the special sciences. For the Marburg professor Rudolphus Goclenius (1547–1628), who used the word for the first time in his *Lexicon philosophicum* (1613), 'ontology' has the function of assigning each of the scientific disciplines its proper place in a new encyclopaedia of knowledge.

The idea of a systematic encyclopaedia of knowledge deriving from a single principle was fundamental in Calvinist thought. Theology was thought of as a part of the body of knowledge which men have acquired in the course of history. Metaphysics is accordingly not a science in the Aristotelian sense, but one of the liberal arts. Natural theology is part of the science of spiritual being, revealed theology is a discipline made up of commonplaces systematically ordered for the understanding of the Scriptures. Philosophical conclusions are derived from the nature of things. Theological conclusions are derived from revelation and include not only universal, but also contingent, facts depending on the divine foreknowledge. In this sense, Bartholomew Keckermann (1571/73–1609), Clemens Timpler (1567–1624), and Johann Heinrich Alsted (1588–1638) published systems of the various arts in the early 17th century.

In the territories which followed Luther's lead, the Aristotelian metaphysics was thought to provide the basis for the doctrinal unity which the princes needed for the achievement of their political goals. The *Formula concordiae* of 1577 sought to estab-

lish a Lutheran orthodoxy, not only against the adherents of Calvin and Melanchthon, but also against radical Lutherans who maintained that there are doctrines of the faith – like that of the Trinity – which are opposed to reason. In the effort to combat such teachings German philosophical textbooks, like the *Exercitationes metaphysicae* (1603–4) of the Wittenberg professor Jacob Martini (1570–1649) and the *Metaphysica commentatio* (1605) of Cornelius Martini (1568–1621) of Helmstedt, turned to Suárez's notion of a confessionally neutral, possible world which all those who admitted the idea of creation could accept. In spite of Lutheran reservations about the idea of a natural knowledge of God, theologians soon came for apologetic reasons to admit the necessity of a natural theology. Following Pereira's idea of a separate science of spiritual being, the Wittenberg professor Johannes Scharf (1595–1660) published a treatise entitled *Theologia naturalis* in 1621.

Lutheran orthodoxy also attempted to systematize revealed theology in accordance with the Aristotelian theory of practical science. In his *Epitome theologiae* of 1619 Georg Calixt (1586–1656) applied Zabarella's idea of the analytic method to theology, presenting eternal beatitude as the end to be reached, soteriology as the means to the end, and Christology as its principle. Whereas philosophical theology, which has the apologetic function of demonstrating God's existence and human immortality, employs the synthetic method, the practical science of revealed theology proceeds analytically from ends to means and principles.

Modern Study of Aristotle. The last edition of the Latin text of Aristotle's works was published by the Jesuit Silvester Maurus (1619–87) in the year 1668. Although scholastic Aristotelianism continued for apologetic reasons to enjoy a shadowy existence within the confines of post-tridentine Catholic seminaries, the great variety of Renaissance Aristotelianisms and the increasing attention to Aristotle's practical philosophy put an end to Aristotelianism as such around the middle of the 17th century.

Although individual works – the logic, the biological treatises, the *Politics*, the *Poetics* – continued to attract students, the scientific revolution called forth new theories of what science is and a completely new encyclopaedia. Since the Enlightenment, Aristotle has been regarded not as the founder of a hierarchical system of the sciences, but rather as a collaborator in a great effort to understand reality through empirical research in individual, autonomous disciplines.

The publication by the Berlin Academy of the *Aristotelis opera* between 1831 and 1870 and of the *Commentaria in Aristotelem graeca* between 1882 and 1909 has supplied the basis for the modern study of Aristotle and the Greek tradition of his philosophy. The *Aristoteles latinus*, undertaken by the Union Académique Internationale in 1939 for the edition of the medieval Latin translations, has contributed to a new understanding of Latin Aristotelianism.

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Aristotle

Aristotle can fairly be said to be the founder of metaphysics as a separate discipline, as well as one of the most influential theorists of metaphysics. Born in Stagira in 384 BC,

Aristotle came to Athens around 367, when he entered Plato's Academy as a student. He is known to have become a lecturer in the Academy, departing about the time of Plato's death in 347. After teaching in the court of Hermias of Assos, doing biological research on Lesbos with Theophrastus, and becoming one of the tutors of Alexander at the court of Philip of Macedonia, he returned to Athens in 335–4 to found his own school, called the Lyceum or the Peripatos. He departed from Athens in 323 because of anti-Macedonian agitation, and died in Chalcis in 322.

Aristotle was not the first philosopher to concern himself with metaphysical issues, but he was the first to study metaphysics systematically and to lay out a rigorous account of ontology. In some of the basic notions of his system he is much indebted to Plato. But he opposes Plato on fundamental issues and shows a concern for details and application which carries him far beyond the sometimes vague generalizations of Plato.

Aristotle's early treatise the *Categories* provides a basic ontological theory. In Chapter 2 of this work Aristotle introduces the independent distinctions of entities in a subject/not in a subject and entities said of a subject/not said of a subject. The former distinction is that between the 'accidents' or non-essential characteristics and the substances they characterize; the latter distinguishes universal features from individual instances. Both distinctions are original with Aristotle, providing what have come to be standard categorial distinctions. Aristotle treats all entities as classified by his four-fold scheme, and it is those which are neither in a subject nor said of a subject which he will identify as the ultimate realities. In other words, he takes as the basic independent entities of his ontology those things which are always (ontological) subjects and never predicates, items such as 'a certain man', 'a certain horse'. Thus familiar natural objects such as Socrates and Bucephalus become the ultimate realities of Aristotle's world.

In Chapter 4 Aristotle identifies ten classes of entities: substance and nine classes of accidents. And in Chapter 5, after distinguishing primary (particular) substances such as a certain man from secondary (universal) substances such as Man, he explains why primary substances are prior: all other entities depend for their existence on primary substances. Thus there is a determinate structure of reality with primary substance as its foundation. Primary substances such as Socrates are *essentially* Man, Animal, etc., and *accidentally* white, literate, etc. But without items like Socrates there would be no characters, whether essential or accidental, in the world.

Aristotle's physical treatises introduce complications into the notion of primary substance as a subject of all predications. Scholars disagree as to whether these complications mark a stepwise elaboration of his theory or a theoretical evolution on Aristotle's part; and if the latter, whether the new theory is consistent or inconsistent with the old. In any case, one finds far-reaching developments of substance theory in the physical works.

The most important complication, presented in *Physics* I, is the introduction of form and matter. Having set for himself the problem of how change can take place, Aristotle faces a special challenge in explaining how the subject of all predicates, the particular substance, can come to be. For there is a danger that if substance comes to be, something will have come to be from nothing. Aristotle confronts the problem by distinguishing matter, the underlying substratum of change, from form. The matter is present throughout the change, but the form comes to be present at the end of the process. Thus form and matter are principles required for explaining the genesis of substance. Furthermore, the form and matter continue in the substance that has come to be; hence they are permanent components of the substance. Aristotle's scheme of four causes, or four types of explanatory factors, incorporates matter and form: the formal cause tells what a thing is, the material cause what it is made of; while the efficient cause tells the source of movement and the final cause tells that for the sake of which something happens.

Aristotle sometimes compares the matter/form distinction with the potentiality/actuality distinction. The latter differs, however, in

representing the states of completeness of substances rather than their components. An acorn is potentially an oak tree, but it becomes the tree in actuality only after a process of change. Not every kind of matter is potentially an oak tree but only the kind of matter which will grow into the tree under normal conditions if nothing interferes (*Met.* IX.7). Hence one can say that something is potentially *x* in virtue of actually being *y*. Actuality is prior to potentiality in several senses, and especially in the sense that becoming is for the sake of being and matter for the sake of form (*Met.* IX.8). Hence the theory of actuality tends to suggest that nature is so arranged as to have a tendency towards the maximum amount of organization. Aristotle assumes a pervasive teleology in nature which he associates with the dominant role of the final cause in explanation.

The matter/form and potentiality/actuality distinctions enable Aristotle to develop further metaphysical analyses. One of his most important applications of the distinctions is to his analysis of living things. The soul is the form or actuality of a natural body of the right sort (*De An.* II.1). Since the soul is the actuality of body, it is not, in general, able to survive the body. There is, however, an active intellect which does survive. There is also an everlasting cosmic intelligence (or a set of them) whose existence can be inferred from the continued existence of motion in the cosmos (*Phys.* VIII, *Met.* XII). This intelligence, the Unmoved Mover, is an actuality without potentiality.

The matter–form analysis can also be applied repeatedly to physical bodies to yield different levels of material composition: the body of an animal or plant is composed of non-homogeneous parts (limbs, organs, etc.), which in turn are composed of homogeneous parts (tissues, etc.), which are composed of combinations of the four elements (earth, water, air, and fire). The four elements change into one another and so seem to require a basic characterless substratum, prime matter. It is now controversial whether Aristotle posited the existence of prime matter; but if he did, the concept did not occupy the important place for Aristotle that it did for his medieval followers.

In the *Metaphysics* Aristotle subjects to scrutiny his own metaphysical principles. Our word 'metaphysics' itself derives from the expedient of early editors of Aristotle who, not knowing what to call his books on first principles, called them τὰ μετὰ τὰ φυσικά, the material after the physical enquiries. Whether the fourteen books of the *Metaphysics* are a unity or a collection of disparate treatises is a matter of serious debate. Aristotle clearly recognizes a special study corresponding to metaphysics, which he calls variously wisdom, first philosophy, and theology.

But the books of the *Metaphysics* seem to present different conceptions of what metaphysics is. In Book I Aristotle identifies wisdom with knowledge of the ultimate causes and principles, which he identifies as the four causes. Book IV makes metaphysics an enquiry into the causes of being *qua* being, an enquiry made possible by the fact that all senses of being are related to a single central notion, the notion of substance. Book VI argues that the highest science must study the highest genus of substance, which is the divine, and hence this science must be theology. Of course, it is not surprising that metaphysics should take in studies of causation, of ontology (the study of the basic entities of the world), and what was later called special metaphysics (the study of special kinds of beings, e.g. God and the soul); but precisely how these enquiries were related in Aristotle's mind remains obscure.

The most interesting and difficult section of the *Metaphysics* consists of the central books – VII, VIII, and IX. Whatever may be the case with the other books, the central books evidently belong together as a connected series. Books VII and VIII deal with the problem of what the ultimate reality is: is it the form, the matter, or a composite of the two? The problem seems to arise as a difficulty in reconciling the apparently simple substance of the *Categories* with the complex substance composed of matter and form described in the physical treatises. In the *Categories* there is no problem as to what the real substance is: it is the individual of a natural kind, such as Socrates. But if we now analyse substance into form and matter, it is

unclear which entity is the ultimate reality. In fact, Aristotle rejects the composite (e.g. Socrates) in Chapter 3 of Book VII, and he argues that matter is too indeterminate to be substance. This leads one to expect a straightforward argument to make form the ultimate reality. Aristotle goes on to discuss essence, which he seems to identify with form, but his study of essence is inconclusive, and it tends to suggest that primary substance is something universal such as Man. In Chapter 13 Aristotle brings his examination of essence to a sudden halt with a pointed argument that substance cannot be universal. In Chapter 17 he explores the idea that the formal cause, by unifying the components in a complex, is the ultimate reality; and in Book VIII he investigates the claim of form in the sense of actuality to be substance. Book IX deals with the general theory of potentiality and actuality without, however, explicitly resolving the problems raised in Books VII and VIII.

The problems of substance can be seen as deriving from Aristotle's tendency to espouse three jointly inconsistent claims: (1) form is substance, (2) form is universal, and (3) no substance is universal. Modern interpretations of Aristotle typically try to justify on his behalf the rejection of one or other of the claims. But there is no consensus concerning which claim to reject, nor how to reject it.

Despite his difficulties in clarifying the first principles of his theory, Aristotle uses his metaphysical concepts to great effect, organizing the whole range of his philosophical theories around them. His syllogistic logic, the first system of logic developed, is closely related to the theories of substance and predication of the *Categories*. His theory and practice in science consist of attempts to identify and define essential properties of substances. And his ethical and political thought is based on a determination of the full actualization of human potential – in other words, on the essence of the substance man. Since man is a rational animal and also a social animal, the best life for him will be rational life in a society.

Thus although Aristotle did not provide clear answers to his own ultimate questions about being, he produced a highly integrated system in accordance with his metaphysical insights. The scope and rigour of his thought have continued to inspire generations of philosophers. Due to a variety of factors, including the unavailability of his works at various times, he has suffered periods of neglect followed by remarkable revivals. Aristotelian revivals occurred in the 1st century BC, the early Middle Ages among the Arabs, the 12th–13th centuries AD in the Latin tradition, the 15th–16th centuries in the humanistic tradition, and the 19th and 20th centuries in the context of such diverse causes as metaphysical realism and ordinary language philosophy. Moreover, there has existed since the first revival a tradition of commentaries on Aristotle's works that was for many centuries a major vehicle for scientific and philosophical publication. A. N. Whitehead's remark that the history of philosophy consists of a series of footnotes to Plato can be said to apply much more literally to Aristotle than to his master.

In particular, Aristotle's theory of substance, modified to suit different ages, continued to be the dominant ontological theory down to the 18th century. Thus Descartes's metaphysical dualism was a theory which posited two ultimate kinds of substance, thinking and extended substance. Spinoza, Leibniz, John Locke, and George Berkeley developed their own theories of substance by modifying traditional Aristotelian conceptions. David Hume's attack on the notion of substance provoked Kant's account of substance as a pure concept of the understanding. While the concept of substance has largely been displaced by other ontological principles in recent times, Aristotle's theories of matter, form, essence, potentiality, actuality, and causality have made lasting contributions to the language and theory of philosophy and science.

See also: **Aristotelianism.**

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Armstrong, David M.

Armstrong (born 1926) is one of Australia's leading contemporary philosophers. The basic subjects of Armstrong's writings are, on the one hand, the nature of mind and its various states – which he studies systematically from a decidedly materialist point of view – and, on the other hand, general ontological problems, especially concerning universals and laws of nature.

Armstrong (1961) argues that the main theories of perception may be conceived as answers to the question "What is the direct object of consciousness in perception?" While representationalism and phenomenalism answer that the direct object of perception is always a phenomenal entity, a so-called sense-datum or sense-impression, direct realism holds that the direct object when we perceive is never anything but a physical existent. Armstrong raises a number of objections to representationalism and phenomenalism, and develops a version of direct realism which reduces perception to the acquiring of beliefs, or inclinations to believe in, particular facts about the physical world. He then seeks to explain the phenomenological similarity between sensory illusion and veridical perception by appeal to the fact that identical beliefs are acquired in each case. The difference is explained by the respective falsity or truth of the beliefs acquired.

Later (1968) he develops a general account of the nature of mental states and mental concepts, an account which divides into two logically independent parts. One part is a conceptual analysis, an analysis of what we mean when we talk about the mind or particular mental states. The other part is an empirical hypothesis about the ontological status of mental phenomena. The first part is the fullest articulation of the causal or functionalist analysis of mental concepts, the central idea being that when we ascribe a mental state to a person we are saying that the person is in a state which is brought about by certain stimuli, and which in turn has a certain role in the causation of his behaviour. But this causal analysis entails nothing about what kind of states play these causal roles; it is topic neutral, compatible with both materialism and its denial. Armstrong urges, however, that the results of modern science provide overwhelming evidence for the view that the inner states are identical with physical states of the central nervous system.

Armstrong (1973) gives a detailed account of belief. A belief state is characterized as a complex mental state, which, following F. P. Ramsey, is compared to a map of the world, a map in the light of which we are prepared to act. Armstrong then goes on to advance a version of the correspondence theory of truth, according to which belief states correspond or fail to correspond to states of affairs in the world. On the issue of knowledge, Armstrong defends an 'externalist' view, one which construes knowledge as a true belief standing in some natural relation to the situation that makes the belief true. Causal theories of knowledge are rejected, and a 'reliability' theory developed, the notion of reliability invoked being a nomic one. Roughly, the idea is that a knower is a reliable indicator of states of affairs in the world in that by physical necessity he believes that p only if it is the case that p.

Armstrong (1978) is devoted to the problem of universals. Armstrong argues that there are universals; that is, properties and relations. Various forms of nominalism and transcendent realism are criticized and a realism of a non-relational, immanent sort is defended. According to this immanent realism, universals are governed by a principle of instantiation to the effect that a

property must be a property of some particular and a relation must hold between particulars. Denying uninstantiated universals involves denying that a universal corresponds to every general term. Thus he rejects the notion that what properties there are is to be determined semantically. He calls the realism that results from simply moving from meaningful general terms to universals that are the meanings of these terms '*a priori* realism'. Against it, he advocates an '*a posteriori*', or 'scientific realism', which holds that just what universals there are in the world is to be decided *a posteriori* in the light of total science. One of the most interesting aspects of his theory is the way it links universals and causal powers such that every universal bestows a characteristic causal power on the particulars which instantiate it.

Armstrong (1983) ties his theory of universals to the topic of laws of nature. After criticizing the regularity theory of laws of nature, according to which such laws are simply universal generalizations, he develops a theory of laws of nature as contingent relations between universals, relations he calls 'nomic necessitations'. It is urged that these relations between universals entail the corresponding regularity, while the regularity fails to entail the relation between universals. The theory is then extended to functional and probabilistic laws.

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RICHARD SCHANTZ

Art

Metaphysical theorizing about art, especially in this century, has mainly focused on two central questions:

1. The first problem is about how particular works of art are identified or individuated: for instance, which are the criteria for identifying a musical performance as an instance of a particular work of music?
2. The second problem concerns the general categorial construction of artworks: what kind of entities are works of art?

Of course, an answer to one of these questions will be closely related, both logically and causally, to answers to the other, and favoured positions with regard to both reflect larger strategies in general comprehensive ontology or metaphysics.

Discussions of the identity of works of art have to a large extent focused on the relation between art and physical objects. Reductive materialism in the arts which identifies artworks with physical objects *simpliciter* (e.g. C. J. Ducasse, 1929, *The Philosophy of Art*) has been forcefully rejected (Hoffman 1962), and the prospects for a successful analysis of the ontological status of artworks within such a framework are minimal. First of all, in the arts of music and literature there is no single physically located entity with which to identify what we call 'the work of art'; we cannot identify the work of art with any particular instance of it. And, second, even in those arts – such as painting and sculpture – where there is a particular physical object which is a candidate for such an identification, difficult problems arise if a complete reduction is made: we customarily ascribe to works of art representational and expressive properties, but such properties cannot, it has been argued, be ascribed to physical objects *simpliciter* (Wollheim 1968). Margolis (1980) has proposed a non-reductive materialist account with his analysis of works of art as "culturally emergent and physically embodied entities", which avoids the difficulties mentioned above by construing artworks as something embedded in, but not reducible to, physical objects. The very nature of the entity thus embodied and the embodiment itself, however, remains to be more fully explained.

Idealism with respect to art, mainly associ-

ated with the Croce–Collingwood tradition (most clearly stated in R. Collingwood, 1938, *The Principles of Art*), identifies the work of art with a mental state, e.g. an 'imaginative experience', in the artist. The physically located objects (or events) referred to when speaking of art are merely attributed the status of being 'records' of the mental state (i.e. the artwork) within the idealist framework. The basic common-sense assumption that works of art are public objects (or events) can thus not be accommodated within this framework. Nor can it account for the fact that artworks, once created, are thought to persist in time and space, independent of the mental life of the artist. Furthermore, in those cases where there is a discrepancy between the mental state of the artist and the product of his creative efforts, the idealist will be committed to the position that the mental state is the work of art, and that the piece exhibited at museums, theatres, and so forth, is a false 'record' of it.

Another kind of idealist theory is provided by Arthur Danto (*The Transfiguration of the Commonplace*, 1981). According to him, an artwork cannot be identified with a 'real thing', e.g. a physical object, since it may be the case that of two objects indistinguishable in their perceptual properties, only one is an artwork; for instance, although Marcel Duchamp's *Bottle Rack* is perceptually indistinguishable from another bottle rack, nevertheless the former but not the latter is a work of art. A central thesis in Danto's philosophy of art is that to decide whether something is a work of art or not requires a 'theory' (the word is used in a weak sense, to be equated with 'structure of thought') and an 'artworld'. Artworks are 'metaphors' with their own interpretations as constitutive parts of them – e.g. Duchamp's *Bottle Rack* is 'a-bottle-rack-as-art': hence, artworks refer to themselves and to art in general. Danto's theory is tailored to fit artistic developments of this century, such as found art, conceptual art, and so forth, but it claims applicability to traditional art as well (which, however, is highly debatable since these kinds of art appear to differ in many crucial respects). Apart from some obvious obscurities in Danto's ontology of art – e.g. in what senses are the expressions 'metaphor' and 'interpretation' used? – it either suffers from circularity, or is parasitic upon a concept of art left unexplained in the theory.

It has been widely debated whether all arts can be given the same ontological construal, or if it is necessary to make some basic distinctions between different ontological categories of art. Joseph Margolis (1980), for instance, belongs to the former group and he subjects artworks of all kinds to an overriding analysis within a general theory of cultural objects. Philosophers such as Richard Wollheim (1968) and Nicholas Wolterstorff (1980), on the other hand, have argued for the need to divide the arts into two basic categories: the singular and the multiple arts, respectively. Artworks belonging to the former, e.g. paintings, sculptures, etc. are particulars with physical and temporal location; whereas artworks belonging to the latter, such as, for instance, musical and literary works, etchings and engravings are of a more abstract sort (e.g. types or kinds), capable of being multiply exemplified or instantiated in space and time (by performances, copies, etc.), but which do not themselves admit of physical or temporal location. Nelson Goodman (1968) proposes a different kind of categorization with his division between the 'autographic' and the 'allographic' arts. This division is explained as follows: a work of art belongs to the autographic arts if and only if the distinction between original and forgery as applied to it makes sense; if not, then it is an allographic artwork. Hence, the concept of authenticity is thus what marks the distinction. It seems hard to save the autographic-allographic dichotomy from collapsing into the division between the singular and multiple arts; being autographic coincides with being singular, and being allographic with being multiple. Goodman, however, argues otherwise, and contends that there are autographic artworks that are both singular and multiple depending on what stage of their production we are considering.

The problem of individuation and identification in the arts is particularly perplexing with regard to music and literature, owing to the possibility of multiple instantiation of

works belonging to these art forms, and the question is how the numerical identity of the work is ensured in its various instances, i.e. the performances and copies of the work. The controversy has been whether to adopt formalist or contextualist criteria of identification. The choice between the two different approaches is ultimately determined by one's view of the role of the ontologist of art: should he capture the actual structure of our thought and talk about art, or should he provide 'a better structure'?

Roman Ingarden (1930, *Das Literarische Kunstwerk*) has in his phenomenological account of the literary work suggested that the work is to be seen as 'derived from' its realizations on the part of its reader. This, however, generates the problem of explaining how the work can remain the same, given increases in the number of realizations and varying realizations. Many philosophers in the last decades (e.g. Stevenson 1957, Wollheim 1968, and Wolterstorff 1980) have maintained that the type/token distinction is central in the ontology of art, and they have proposed that literary and/or musical works of art are universals (types or kinds), with performances and/or copies as their tokens (or instances). Much of the discussion has centred around the problems of the relation between type and token (work and instance), and the status of the type. It has been debated whether type and token can share properties (Wollheim) or share predicates (Wolterstorff). Margolis (1980) has pointed out the difficulties which arise if the type is construed as something ontologically distinct from its tokens, and his own proposal is that works of art are 'tokens-of-a-type' and that types *per se* are only heuristically introduced in order to facilitate the identification of two 'tokens-of-a-type' as 'tokens-of-the-same-type' (it is unclear in what respect this solves any problems). Those committed to a nominalist position would be inclined to construe types as classes of instances (see e.g. Goodman 1968); there is, however, a difficulty in construing artworks as classes, which consists in the consequence that e.g. a work of music would change over time as the number of performances belonging to the class was increasing. Platonistically minded philosophers (Kivy, 1980, "Platonism in music: a kind of defense" and Wolterstorff 1980) have proposed a realist account of, primarily, works of music as universals, construing them as abstract sound structures, pre-existing prior to instantiation and conception. Kivy argues that musical works are discovered, not invented, existing before discovery as musical possibilities: in this framework we thus have to distinguish between those works that have been discovered and those which have not. Jerrold Levinson (1980, "What a musical work is") has argued against the construal of musical works as pure sound structures in his historicist account of musical works as sound structure types which are indicated (created) at a certain time, by a certain composer, and with specific means of performance integral to them.

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JEANETTE EMT

Artefacts

To thank Apollo for saving the lives of Theseus and his fourteen passengers, the Athenians would each year send Theseus' ship on a sacred voyage from Piraeus to Delos. As the ship required continual repair involving substitution of new planks for old, Plutarch records that several years on a debate arose amongst Athenian philosophers about whether the ship currently making the voyage was the same ship as the ship Theseus had sailed to Crete (*Life of Theseus* §22–3; see also Plato's *Phaedo*, 58A, 87). Thomas Hobbes embellished the example by supposing that as the old planks were removed,

they were saved by someone who later put them together in the same order (*De corpore* II, 11). Which is the ship of Theseus, this person's construction or the ship currently sailing to Delos? David Wiggins (1980, p. 93) notes that if admirers of Theseus were to decide to raise a monument to him and put his ship on it, they would want the reconstructed ship – but priests of Apollo might insist on the other candidate.

The example threatens cross-temporal identity criteria for artefacts. It seems too extreme to hold that replacing a part of an artefact amounts to destroying that artefact and bringing a new one into existence. On the other hand, permitting complete replacement of parts through time leaves room for the rival candidate reconstructed from the original parts. Those with one set of interests may say that the reconstruction is identical to the original thing; those with another, that the descendant is identical to the original thing. Such problems lead Wiggins to express a certain scepticism about the ontology of artefacts: "there is a point to be found in Aristotle's doctrine that natural things are the real beings *par excellence* to which everything else is secondary" (p. 98).

The question of how much an artefact can change its original composition through time and remain the same has a modal analogue: how different could a given artefact have been from the outset? Again it seems too restrictive to insist that a given artefact could not have originated made of slightly different components. But then we are off down a slippery slope of possible worlds to a world where the given artefact is made of totally different components from the outset, whereas, intuitively, we think a given artefact could *not* have originated from totally different components (Chisholm 1968).

Some have seen in this puzzle a reason to doubt that **S5** is the correct system of modal logic to capture our informal notions of metaphysical possibility and necessity (Chandler 1976, Salmon 1986). Suppose A is our actual artefact, X is a world where it originates with a make-up not too different from its actual make-up, and Y is a world where the artefact which originates is too different for us to agree that it is our actual artefact. Yet the number of parts changed between the actual world and X, and X and Y, may be the same. If that *amount* of change preserves identity, then by transitivity, the artefact in Y *is* the actual artefact. But if we lay down an accessibility relation between worlds, then the principle of identity preservation for an amount of change m can be stated as: if W is a world where A exists then there is some accessible world W^* where A originates changed to some degree $k \leq m$. In our example, X is accessible from the actual world and Y is accessible from X. But if Y is not accessible from the actual world, we do not have to concede that it is possible for A to have originated with a degree of difference $2m$, only that it could have been possible. In this set-up, accessibility is not transitive, so **S5** has been rejected. However, there is also another resolution of the puzzle which preserves **S5** and draws a closer parallel with Sorites paradoxes, in which the non-transitive accessibility relation between worlds is replaced by a non-transitive counterpart relation between worldbound individuals (Lewis 1968, 1986; Forbes 1983).

Work on artefact identity has wider significance for identity problems in general. Can conclusions drawn in the modal case be read back to the temporal case? It seems not: even if we agree that an artefact could not have originated from totally different parts, we can still say that it can come to have totally different parts, so long as we deny that a constitution which is possible at some time in the career of an artefact is *ipso facto* a possible original constitution for it. There is also a sense in which problems about personal identity parallel problems about artefact identity, suggesting the possibility of an argument to the conclusion that persons are "not real beings *par excellence*" (Parfit 1984, Johnston 1987).

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GRAEME FORBES

Artificial Intelligence

By artificial intelligence (often abbreviated to 'AI') is meant a domain of research, application, and instruction that is concerned with programming computers to perform in ways that, if observed in human beings, would be regarded as intelligent (Simon, foreword to Shapiro 1987). The term was first coined for the Dartmouth Summer Research Project on Artificial Intelligence in 1956, where Allan Newell, Clifford Shaw, and Herbert Simon presented one of the first artificial intelligence programs, the *Logic Theorist*, a program capable of proving on its own a number of theorems from *Principia Mathematica*. Today, artificial intelligence can generally be considered to be a discipline of computer science which focuses on methods and techniques for dealing effectively with large search spaces. Since the early stages of its development, it has led to new programming languages, techniques for representing knowledge and states of the world, and methods for searching and making inferences. The main applications today cover speech recognition and natural language processing, image recognition and processing, robotics, tutorial systems, and so-called expert systems for various application domains, which seek to take over the role of the expert – e.g. in medical diagnosis or oil prospecting.

The philosophical basis of artificial intelligence consists in the view that thinking and problem-solving consist essentially in the manipulation of symbols (Allan Newell, "Physical symbol systems", 1980). According to this view, intelligence depends only on a system's organization and functioning as a symbol manipulator. Since a computer is an *interpreted automatic formal system*, the claim is that human thinking and problem-solving can in fact be simulated on a computer. While the computer simulation of, say, a thunderstorm does not, of course, result in a thunderstorm, it is the case, according to artificial intelligence, that the computer simulation of a cognitive process itself actually *is* such a cognitive process, since both the simulated and the simulating rely on the same principle of symbolic manipulation. This position, which sees computer programs as providing explanations of psychological processes, has been called the 'strong' thesis of artificial intelligence (John Searle, *Minds, brains, and programs*, 1980, p.2). The more modest view, which claims that computer programs are a useful and powerful tool for researching into the human mind and for testing and verifying psychological explanations, has been termed the 'weak' thesis of artificial intelligence.

The strong thesis is based on the so-called Knowledge Representation Hypotheses widely accepted in AI-research:

> Any mechanically embodied intelligent process will be comprised of structural ingredients that a) we as external observers naturally take to represent a propositional account of the knowledge that the overall process exhibits, and b) independent of such external semantical attribution, play a formal but causal and essential role in engendering the behaviour that manifests that knowledge (Smith 1985).

Thus, the basic elements of a representation system are considered to play a double role. For an observer they function as semantically interpreted signs, while within the system they play only a formal-syntactic role. Both levels of consideration are non-trivially related, because every admissible formal-syntactic manipulation of these 'structural ingredients' can be given an admissible (external) semantic interpretation. To the extent that a representing system is based on a formal model of the semantics intended by the observer, it can then be considered as intelligent.

There is no doubt that artificial intelligence

has led to important technological innovations. It also represents a substantial challenge to traditional philosophy and psychology. Although artificial intelligence is rooted to a large extent in the views of the Vienna Circle with respect to epistemology and philosophy of science, and can even be said to continue and elaborate these within the framework of computer science, it was in no small part responsible for overcoming behaviourism as the standard paradigm of psychological research, and has significantly contributed to the development of cognitive science. From the philosophical point of view, one of its main contributions consists in the demonstration that it not only makes scientific sense to refer to mental states and cognitive processes, but that it is also possible to treat of them scientifically in an exact manner. That is, it is possible to take into account the introspectively available content of a cognitive process, the how of an intelligent solution to a problem, an idea which significantly broadened the scope of epistemology at a time when anti-mentalism was still very much to the fore.

While the weak thesis of artificial intelligence is uncontroversial, the strong thesis, insisting on a non-metaphorical similarity between minds and programs, has been criticized on various grounds. John Searle (*Minds, Brains, and Science*, 1984) rests on the intuition that human beings know what they mean, and that they have an immediate understanding of meaning. In contrast, it is conceivable that AI-systems only mimic understanding, and that in reality their capacity to understand symbols is borrowed from us human beings, who first assigned meaning to these symbols. Searle concludes that programs may be necessary, but that they are not sufficient to cause understanding, or mental phenomena in general. The causation of mental phenomena, according to Searle, requires in addition a certain kind of biological stuff, viz. the brain.

While Searle attacks the *functionalism* of artificial intelligence, a challenge has been directed also with respect to the computational paradigm which lies at its root by so-called connectionist approaches to computing. While standard AI-research still relies on the von Neumann (i.e. sequential) model of computing, connectionism advocates a highly parallel computational paradigm based on the idea that pieces of information are represented on a non-symbolic level by very simple computing elements (e.g. neurons) that communicate by exchanging simple messages. Complex computations are then carried out by virtue of massively parallel interconnecting networks of such elements. As Schnelle ("Elements of theoretical net-linguistics", 1981) and Feldman ("Connectionist models and their properties", 1982) have argued, the brain, and in particular the processing of natural language, appears to function in a highly parallel, distributed manner, allowing for the interaction of many levels of knowledge. The charge raised by connectionism against artificial intelligence is not that the program or goal of the latter is misguided, but that in view of the combinatorial nature of artificial intelligence problems the symbol-manipulation approach might better be substituted by a connectionist approach.

Finally, Dreyfus (*What Computers Can't Do*, 1985) and Winograd and Flores (*Understanding Computers and Cognition*, 1987) have argued that understanding and problem-solving always take place in a framework of communication, and that the individualistic approach to thinking and understanding assumed by artificial intelligence (and connectionism, for that matter) is therefore inadequate. Understanding, according to their criticism, is not a fixed relationship between a representation and the things represented; rather, it is a commitment to carry out a dialogue within the common world-knowledge of both speaker and hearer in a way that permits new knowledge to emerge. Thus they explicitly call for a critical assessment of the initial goals of artificial intelligence, and for a new conception of how computers, intelligent or not, can be integrated into people's lives.

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GERHARD HEYER

Atomism
I: Classical Theories

Atomism evolved as a solution to an ontological problem. In criticism of the theories held by earlier pre-Socratic philosophers, who had stated that the whole universe had developed from one material principle (e.g. fire), Parmenides of Elea (5th century BC), the most prominent member of the Eleatic school, taught that generation and destruction are absolutely impossible, since they imply the transition from not-being to being or vice versa. True being has never come into existence nor will it ever perish, it is unchangeable, immovable, and indivisible.

Later philosophers then had to form a theory which would be both in accordance with this ontological principle of the Eleatics and able to account for the obvious phenomenon of change in the physical world. After the attempts of Empedocles (*c.* 492–*c.* 432 BC) and Anaxagoras (*c.* 500–*c.* 428 BC), which revealed a slight inclination to a corpuscular conception of matter, it was Leucippus (fl. *c.* 450 BC), the founder of a philosophical school at Abdera about 430 BC, who developed atomism as an answer to this problem. Generation and destruction are the result not of a transition from not-being to being or vice versa, but of the combination and separation of entities – i.e. indivisible, indestructible, and immutable particles which are too small to be seen. Their indivisibility is ascribed in the main to their solidity. Since locomotion of the atoms is the basis of physical change, Leucippus had to adopt a second principle to make locomotion possible: the void, the existence of which had been denied by the Eleatics.

Starting from these two principles, the full and the empty, Leucippus and his better-known pupil Democritus (*c.* 460–*c.* 370 BC) evolved a mechanistic theory both of the formation of the universe and of the things within it. The atoms are eternally in spontaneous motion through the void. As a result, they collide with one another and become entangled or dispersed. The entanglement of atoms is a purely mechanical process, based on complementary forms (e.g. convex and concave atoms, hook and eye). The collision of larger aggregates of atoms causes a vortex in which the finer ones go to the periphery, the larger ones to the middle. Due to this process of condensation and thinning, a world is formed with an earthy centre and the small, agile particles of the celestial spheres around it.

Since all the atoms are alike in substance and without 'sensible' qualities, they differ in only two respects: shape (there is an infinite variety of atomic shapes) and size (and probably, as a consequence, weight). All 'secondary' qualities of the compounds originate in the shape of the particles and in their position and arrangement in the aggregate. Taste, for example, originates in the shape of the atoms, colour in their arrangement. Every sensation is due to the efflux of particles from the bodies sensed; sight results from fine films or images which are constantly being thrown off the surface of things and travel through the air to the eye, where they stir the soul-atoms by direct contact.

These are the major outlines of the first materialistic world view denying divine influence and any sort of plan in the universe. All processes happen with necessity, as Democritus points out, resulting from the entanglement or dispersion of colliding atoms.

Atomism had already suffered harsh criticism from Aristotle when it was revived by Epicurus (*c.* 342/1–271/0 BC). His motive was mainly ethical. The materialistic world view of the early atomists was well suited to his main aim of freeing mankind from the fear of the gods and of punishment after death.

Compared with the theory of Leucippus and Democritus, there are significant alterations in the detail of Epicurus's doctrine. First, weight becomes an important factor with regard to atomic motion. It causes the particles to fall perpendicularly through the void. Since collisions would thus be impossible (the speed of all bodies falling through the void being the same), Epicurus introduces a new idea into the theory of atomic motion: the atoms swerve at random from time to time. Thus an element of chance replaces the stern Democritean determinism. The collision of atoms causes entanglement or dispersion and thus motion in all directions – the precondition of a cosmogonic process. There is also some modification as regards the shape of the particles. The atoms, which are physically indivisible because of their hardness, can be divided by thought into minima of extension. Size and shape of the atoms result from the number and the arrangement of these minima. Since there is a certain limit on the size of atoms, the number of atomic shapes is finite.

Some sixty years before Epicurus, Plato (in his *Timaeus*) had developed a corpuscular theory of matter which is more an intellectual experiment than a physical conception. It combines the Empedoclean notion of the four elements with atomistic ideas and geometrical speculation. Only four different shapes of particles exist, the purest three-dimensional geometrical figures, the regular polyhedra. Each shape is characteristic of the particles of one element: the tetrahedron of fire, the octahedron of air, the icosahedron of water, and the cube of earth. This theory probably originates in the speculation of the Pythagorean Philolaus (5th century BC). The properties of the elements are largely due to the shape of their particles. Thus fire burns because of the sharp edges of its tetrahedral corpuscles. Plato's theory differs from that of Democritus in two important respects. First, Plato denies the existence of an extended void. There are only small intervals between the corpuscles. Second, the particles are not indivisible. In order to account for the transformation of one element into another, Plato holds that the particles can be split up into the elementary triangles that form their surfaces. Due to the different number of these triangles, one particle of air, for example, can be divided into two particles of fire.

Because of its speculative character Plato's theory exerted no strong influence on natural philosophy of later times, whereas Democritus's atomism was taken over by several philosophers, who, however, tried to modify some of its extreme positions. Thus the Pythagorean Ecphantus of Syracuse (4th century BC) taught that the motion of the atoms through the void is directed by a divine force. Heraclides Ponticus (*c.* 390–310 BC) based his theory on corpuscles that are susceptible of certain secondary qualities. Strato of Lampsacus (head of the Peripatetic School from 288/4 BC) made a distinction between an extended separate macro-vacuum and a micro-vacuum dispersed between the particles of the aggregates. Denying the existence of the first, he adopts the second in order to explain the transmission of light and the compressibility of air. This theory was later taken over by Philo of Byzantium (3rd century BC) and Hero of Alexandria (1st century AD). In medicine, atomistic concepts were used by Erasistratus of Ceos (*c.* 300–240 BC) and Asclepiades of Bithynia (*c.* 120–30 BC), who regarded the obstruction of small pores through which the particles must pass as the cause of diseases.

Beyond this, however, atomism was not widely accepted in antiquity, as all the leading philosophical and medical schools rejected it. Its main failure was that it could not account for the order and regularity in natural processes and for the fact that the nature of a compound is often completely different from that of its components.

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BERNHARD PABST

Atomism
II: Medieval Theories

Standard histories of atomism assert that the Middle Ages are characterized by the virtual absence of corpuscular theories. This opinion has recently been disproved (see Pabst 1985).

As a result of the general separation of the West from Greek culture and language in late antiquity, the thinkers of the Middle Ages had no direct contact with the writings of the ancient atomists and with the accounts of them in Greek sources. Nevertheless, a host of detailed information about Democritean and Epicurean atomism was passed down in Latin texts of both profane (e.g. Cicero, Calcidius, Servius) and patristic (e.g. Lactantius, Ambrosius/Basilius, Augustine) provenance. On the other hand, only faint echoes of the Platonic theory were known to medieval philosophers, since the section about geometrical corpuscles had not been included in the partial translation of the *Timaeus* by Calcidius.

In the early Middle Ages, interest lay mainly in the lexical, not in the physical aspects of atomism. From Isidore of Seville (*c.* 560–636) onward, many writers concern themselves with the meaning of '*atomus*' and with the major outlines of the Epicurean theory, but none of them explicitly states whether or not such atoms exist.

The revival of atomism coincided with the general revival of natural philosophy in the 12th century. Not yet influenced by the Aristotelian world system and its hylomorphism, philosophers sought for a naturalistic explanation of all physical phenomena, tracing them back to the four elements and their qualities.

In the first half of the 12th century, atomism was accepted by nearly all leading philosophers and thus reached a general popularity it had never enjoyed before and would not enjoy again for almost 500 years. Odo of Cambrai (d. 1113) seems to be the first to have explicitly stated that all bodies are composed of particles which are indivisible because of their smallness. Shortly afterwards (between 1110 and 1120), Adelard of Bath, a pioneer of rational science whose work had been inspired by the Arabs, published his atomic theory. Matter consists of invisible and indestructible atoms which are able to move independently and even collide. There is, however, no void. Like the ancient atomists, he adopts atomism in order to explain generation and destruction as the combination and separation of particles.

We encounter the first elaborate corpuscular theory in the works of William of Conches (*c.* 1080–*c.* 1154), the most prominent member of the School of Chartres, a loosly knit group of Platonist philosophers with a particular interest in natural philosophy. One source of inspiration for him was Galenic medicine. Galen (*c.* 130–*c.* 201) had defined an element as the ἐλάχιστον μόριον of the bodies, meaning that it is the last part of a body which is not to be resolved into simpler substances. This definition reappears in the Latin translation of the *Kitab al-Maliki* of the Arabian physician Ali ibn Al-Abbas (10th century) that had been made by Constantinus Africanus (*c.* 1010/20–87). Here we read that an element is the '*minima et simpla corporis compositi particula*'. But still, no corpuscular conception is intended. It was William of Conches who was the first to interpret this definition as the basis of an atomic theory. There are, he held, four kinds of particles that possess the specific qualities of the elements; the particles of fire, for example, are hot and dry; those of water are cold and moist. These particles represent the pure elements; whereas the visible substances of fire, air, water, and earth are mixtures of all kinds of atoms named after the prevailing type of atom. The elementary corpuscles form all bodies by cohesion. They are, however, without extension, i.e. punctiform, their indivisibility being due to their smallness and not to their hardness, as the ancient atomists had held. This view, common in medieval atomic theories, laid them open to the Aristotelian criticism that indivisibles without extension can never make up a continuum.

The notion of particles which correspond to the elements and possess their specific qualities (a naïve anticipation of the Daltonian system) was widely accepted in 12th-century thought. The theory of William of Conches was taken over almost verbatim

by the author of a commentary on Martianus Capella attributed to Bernardus Silvestris (fl. c. 1150) and by Vincence of Beauvais (d. 1264). It probably also exerted a strong influence on Peter Abelard (1079–1142) and on the author of the treatise *De generibus et speciebus*. These two latter philosophers support also the position of mathematical atomism, the view that all geometrical bodies are composed of points. Accordingly, Abelard holds that physical bodies are composed of indivisible, punctiform particles. Bodies are formed in natural processes by mechanical mixture of the four different kinds of elementary corpuscles. The author of *De generibus et speciebus*, in contrast, is somewhat closer to Aristotelian hylomorphism. The punctiform atoms which, according to him, make up all extended bodies can be considered as mere corpuscles in the mind, but in reality they always bear the substantial forms (= qualities) of the elements. The compound is, however, not simply a mixture or an aggregate of elementary particles. It is a new nature, determined by a substantial form of its own (down to the 'Socratity' of Socrates). The corpuscles account merely for the extension of the body: a certain number of them are required for the substantial form to supervene.

In contrast to this, Hugh of St. Victor (c. 1100–41) inclines to a mechanistic explanation of physical processes. He uses atomism to distinguish between the divine faculty of creation and the phenomenon of generation and destruction in the physical world. Generation and destruction are nothing but combination and separation of pre-existing atoms. God alone can create or destroy entities. The form of bodies depends on the arrangement of the atoms, a change in their appearance on the locomotion of atoms.

The notion of different particles possessing the qualities of the elements gave rise to one serious problem. As Thierry of Chartres (d. before 1155) put it: How can the elements be transformed into one another (as had generally been assumed since ancient times) if their particles differ in their essential qualities and especially in weight and size? Thierry's solution is revolutionary. The particles of the four elements are, he holds, essentially alike. The differences between light and heavy elements originate in the different firmness of the connections between the particles. While the particles of earth stick firmly to one another and cannot move independently, the firmness of the connections gradually decreases up to fire, where each particle may move freely without adhering to any others. The differentiation of matter into four elements originates in the whirling motion of the lighter elements which presses the particles in the centre together and thus causes them to adhere firmly to one another. Thierry was the first to recognize that the four elements are nothing but four different states of atomically structured matter (solid, liquid, gaseous, and 'fiery'). The transformation of one element into another originates in the gradual loosening of the connections between the particles.

On the basis of Thierry's conception, the author of an anonymous treatise, *De elementis*, evolved an atomic theory which is probably the best devised of the whole Middle Ages. As in Thierry, the elements are simply different states of matter, due to the different firmness of the connections between the atoms. Each element is characterized by the specific intensity of motion or 'kinetic energy' of its individual particles. The atoms of fire exhibit a rapid whirling or oscillating motion (there is no void) independently of one another, whereas the atoms of earth do not move at all in relation to each other. The most revolutionary innovation of our anonymous author is that he traces all qualities of the elements back to one quantitative factor: the characteristic intensity of motion of their individual atoms. The effect of heating or burning exerted by fire may serve as an example of this dynamic-mechanistic system. Due to their high 'kinetic energy', the particles of fire penetrate the solid body, collide with its particles, loosen the connections between them and set them in motion individually, a motion similar to their own. Thus the substance becomes gaseous, or at least liquid.

The second half of the 12th century also saw some minor corpuscular theories. The atomic structure of matter was accepted by Peter of Poitiers (c. 1130–1205) and the authors of two commentaries on Plato's

Timaeus. At the end of the century, Urso of Salerno revived the notion of particles which possess the qualities of the elements. There are twelve different species of corpuscles, since each element exists in three forms (the upper, middle, and lower form). Qualities which are alike induce the corresponding particles to cohere in mixture.

At the same time, the Aristotelian arguments against atomism, and especially against the theory that indivisibles without extension might make up a continuum, became known through the translations of the writings of Arabian Aristotelians and were increasingly accepted by Western philosophers. In the first half of the 13th century, the reception of the Aristotelian world system led to a virtual eclipse of atomism. An original version of mathematical atomism is found in Robert Grosseteste (*c.* 1168–1253) who taught that the extension of the universe was created by the infinite multiplication of points of light and matter. Each quantity consists of a certain infinite number of such points. Corpuscular conceptions were also used by him as an explanation of heat and sound.

The precondition for a revival of atomism in the 14th century was a thorough criticism of the Aristotelian arguments. Mathematical atomism was revived by Henry of Harclay (1270–1317), Walter Chatton (d. 1343/4), and Gérard d'Odon (d. 1349), all of whom held that points can form a continuum *secundum distinctos situs*. The arguments of these thinkers were employed by Nicholas of Autrecourt (*c.* 1300–*c.* 60). Like the ancient atomists, he taught that generation, destruction, and change originate in the locomotion of indestructible atoms. In seeking to account for locomotion, expansion, and contraction, he becomes the first medieval atomist to accept a micro-vacuum, while denying the existence of an extended macro-vacuum. In criticism of the Aristotelian theory, he states that points with different *situalitas* constitute a continuum, and that motion consists of instantaneous jumps from one point (or atom) to another and rests of different length on the points.

Nicholas is, however, an isolated figure in 14th-century thought. The domination of the Aristotelian world system and the hostile attitude of the Church prevented atomism from regaining the popularity it had enjoyed among the naturalists of the 12th century.

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Attribute

'Attribute', 'property', 'quality', 'feature', 'trait', 'aspect', 'characteristic', 'moment' are all different terms for roughly the same idea: namely, the ontological complement to *objects* (or *substances*). Attributes are what objects *have* (in some sense or other). Where objects are concrete, determinately located in space and time, and logically self-sufficient – it is held – attributes, the other primary constituent of reality, are abstract, of no definite location, and somehow metaphysically incomplete. The distinction between an object and its attributes is one of the oldest in philosophical thinking, beginning with Plato's Theory of Forms in the *Phaedo*, *Republic*, and *Parmenides*, continuing with Aristotle's discussion in the *Categories*, and of central importance in the metaphysical thought of Spinoza, John Locke, Leibniz, Kant, Hegel, Edmund Husserl, and almost all philosophers since. In this article I shall employ 'attribute' as the most inclusive term for the sort of metaphysical item with which we are concerned, reserving the term 'property' for the most important or fundamental subcategory thereof – such things as being red, being 6 feet tall, and being an electron.

On the linguistic level, attributes are what are ascribed to objects by the predicates – adjectival or verbal expressions – of standard subject/predicate statements; e.g. 'Horace *is*

a bald acrobat' or 'Heather *runs quickly*'. They are often said to be referred to, or at least invoked by, such predicates, much as the objects in question are referred to by the subject terms employed. Having identified an object of discourse we go on, in such statements, to describe it, to say what it is like or how it is behaving, to characterize it as distinct from other things; in so doing we are ostensibly indicating what its various attributes (properties, qualities) are – what attributes it *possesses* or *exemplifies*, to use two standard terms for the connection between an object and its attributes. The list of an object's attributes tells us in what respects it is similar to and in what respects dissimilar to other objects; attributes are what objects have, or may have, 'in common'.

On a simple picture, then, there are the things that basically make up the world – objects – and then there are also, in some sense, the ways, manners, or modes of existing that those objects manifest or exhibit – their attributes, roughly speaking. A full description of the world, on this picture, would have to give at a minimum both all the objects it contained, and all the attributes possessed or exemplified by those objects; that is to say, a tally of all the individual *states of affairs* – understood as the having of an attribute by an object – comprised in the world.

Nominalism, Conceptualism, Realism. Some philosophers deny the existence of attributes altogether (and of *abstracta* more widely), viewing them as either just shadows cast by language, especially general terms (*nominalism*), or else as projections of manufactured divisions existing only in the mind (*conceptualism*). Nominalists divide as to whether the applicability of the same predicate or general term to a number of individuals is to be taken as a brute fact, or is to be further explained by appeal to a primitive notion of *resemblance* among individuals belonging to the class in question. On a *realist* perspective, adopted for the most part in this article, attributes exist as fully as do concrete individuals, and are what grounds and possibly even explains the applicability just mentioned; the individuals to which a predicate applies in common indeed share something, namely, an attribute which they all individually possess.

Attributes clearly differ from *sets* or *classes*, though to every attribute there corresponds, in a given world, the set or class of things that possess it. Since sets are construed extensionally, the set of things having a kidney and the set of things having a liver are the same set, but the attribute of *having a kidney* is manifestly not the same as the attribute of *having a liver*; this is part of what is meant by saying that attributes are 'intensional' entities.

Attributes as Universal. Attributes have generally been taken to be a species of *universal*, ontologically distinct from concrete particulars and instantiated by them, occurring (actually or potentially) at many places and times, and wholly present, in some sense, wherever and whenever they occur.

Among those who accept attributes as universals there has traditionally been dispute (e.g. between Plato and Aristotle) as to whether such attributes can subsist in complete *independence* from particulars whose lot it is, generally, to possess them, or whether they are instead logically inseparable from such particulars, dependent on them for existence. (The issue is sometimes framed as one of the 'transcendence' or 'immanence' of attributes.) Such dispute continues to the present day, with some philosophers (David Armstrong, David Lewis) convinced there are no uninstantiated attributes and others (N. Wolterstorff, Michael J. Loux) as adamant that there are, and that the existence criterion for an attribute is properly that it be logically *possible* for an object to be the corresponding way (e.g. freckled and 10 feet tall), regardless of whether any object actually is.

An additional aspect of attributes viewed as universals, related to though not equivalent to their possible dependence on particulars for existence, was emphasized notably by Gottlob Frege (*Funktion und Begriff* 1891), and later by Peter F. Strawson. Frege, who discussed attributes under the rubrics of 'concept' and 'function', pointed out of such entities that they were peculiarly 'unsaturated' – that they seemed to call for objects to 'complete' them, to fill the metaphysical

'holes', as it were, in their being. Now, although this idea naturally arises out of reflection on the logical form of predicates in a language ('__ is θ'), it appears to transcend the grammatical and to testify to something further: that even if attributes can *exist* uninstantiated, it is in their *nature*, nonetheless, to be instantiated (possessed, exhibited) by objects, that, perhaps, we cannot understand what they are outside of that possibility. The *notion*, at least, of attribute seems to presuppose that of object, i.e. attribute-haver; whether the notion of object in turn presupposes the notion of attribute, or even that of way of being, is less clear.

Next, there is the question (historically denominated the problem of the 'One Over the Many), when attributes are regarded as universals, of exactly how they can in their entirety attach to or be present in a multitude of numerically distinct objects; and, relatedly, whether such attributes constitute *parts*, albeit non-spatial ones, of the objects which exemplify them. Finally, we might mention the issue of our *access* to the kind of abstract entity which is a universal attribute: opinions differ as to whether attributes are perceived in and through their instances, intuited intellectually, discerned via reasoning, or scientifically discovered.

Attributes as Particular. Though attributes are today usually conceived of as universals, some philosophers, notably G. F. Stout (1860–1944), have proposed that the attributes (characteristics) of things are all of them actually *particulars*, unique to the objects having them and in no way shared, repeatable, or multiply instantiated. This proposal has its roots in Aristotle, who suggested that whiteness could be 'in' Socrates in such fashion as to make it his exclusive possession, and the notion was in fact also widely accepted in late medieval philosophy, as well as by Edmund Husserl. More recently, the conception has been developed further by philosophers such as D. C. Williams and Keith Campbell, who dub these absolutely particular attributes 'tropes', and who argue that universal attributes are in effect to be reduced to them, as e.g. sets of maximally resembling tropes.

One might, of course, countenance attribute particulars *as well as* familiar universal attributes – allowing that there is both, say, redness in general, possessed by a given billiard ball, and also, non-identically, that billiard ball's very own redness. But it is possible that only certain kinds of attribute can intelligibly be particularized, can intelligibly be thought capable of assuming a particularized form; if we agree to denominate as *qualities* attributes of the sort *φ-ness*, then it may be that qualities can be particularized in the fashion envisaged by Stout, but that properties – attributes of the form *being* φ – cannot. And this at root may be because properties (e.g. being round) and qualities (e.g. roundness) are conceived to be different sorts of attribute, the one indivisible *conditions* incorporating and expressing *ways of being* (e.g. *round*), and the other abstract *stuffs*, partitionable into bits and admitting of more and less (see Levinson 1980).

Objects and Their Attributes. Attributes are said to be *possessed* or *exemplified* by objects. But what, exactly, is this relation or tie supposed to be? There is an intimacy between an object and its attributes – between a thing and the ways it is – that seems to confound any attempt to explicate this satisfactorily. F. H. Bradley, in fact, argued that it could not be explicated (*Appearance and Reality*, 1897), and that the whole idea of a relation between object and attribute was confused. Against it he offered his famous Regress argument: if in order to constitute a state of affairs an object and an attribute must be related by *exemplification*, then *exemplification*, it stands to reason, must itself be related to both object and attribute, by some yet further relation, call it *meta-exemplification*, which would in turn need another relation to connect it to both *exemplification* and the attribute . . . and so on without end; on such premise, thus, a state of affairs *cannot* even be constituted. On the one hand, we may ask whether Bradley's regress is as vicious as it appears, for it is not clear that such a state of affairs on the standard conception really *requires* or *involves*, rather than merely *generates*, such an infinite sequence of relatednesses. On the other hand, where properties (e.g. *being* φ*s*) are concerned, we might wish to regard the

exemplification or *possession* of a property by an object as something of a *façon de parler*, as a misleadingly externalized expression of a fundamental situation consisting in *an object being a certain way*, where the *being* involved – predicative being – is acknowledged from the outset as primitive. We might rest with saying that certain properties were the properties of a given object, i.e. were the object's properties, where this was the case just in so far as the object *was* certain (correlative) ways, but abandon talk of possession.

Another difficulty in how objects and attributes are related is almost the obverse of the preceding; if in thinking about the *possession* relation we come to doubt whether attributes can ever manage to conspire with objects to form states of affairs, then in thinking hard about these objects *themselves* we begin to wonder whether they are anything *more* than their attributes taken collectively, whether they do not in fact dissolve without a trace into the states of affairs of which they were formerly thought to be constituents. The view that objects are not fundamental entities, but are instead collections or configurations of attributes, is usually called the 'bundle' theory of objects, and has its roots in George Berkeley and David Hume. But it is indeed hard to see how an assemblage of properties can amount to a thing, with nothing to 'have' them. One response to this, favoured by Bertrand Russell, among others, is to say that a spatio-temporal region is the real bearer of the properties involved. This, however, generates its own oddities: Can such a region be *made of tin*? Can it be *sweet*, or *heavy*? Another response is to posit a 'bare particular' – a pure, inherently uncharacterized subject, attained in abstraction by progressively stripping away from an object all of its real determinations – and to declare this the ultimate bearer of the object's attributes. But the identity and individuation conditions of such an entity are at best elusive, and the oxymoronic air of something which is in itself uncharacterized yet the possessor of all characteristics reduces even further the attractiveness of this option. It is possible that the distinction between 'thin' and 'thick' particulars, advanced by Armstrong – roughly, objects conceived of as *in*, and as *tantamount to*, states of affairs – may do something to alleviate the conceptual strain we have been describing.

Two Conceptions of Properties. One tradition of reflection on properties (the central kind of attribute) takes them to be akin to propositions, thoughts, meanings, or concepts – that is to say, entities whose being and individuation are tied to and grounded in the structure of thinking and language. Properties are thus seen as accessible to more or less *a priori* investigation; a difference in conception, in a thinkable way of being, is sufficient for difference of properties. Of course some apparent properties, e.g. being a barber who shaves everyone who does not shave himself, turn out not to be properties, because they are not really limning any coherent way of being, but this too is discoverable by abstract thought. This viewpoint, which we might label the *intensional* one, has been evident in the present essay, and is the dominant one in writings of philosophers such as Frege, Russell, G. E. Moore, R. M. Chisholm, and N. Wolterstorff. In this tradition, some notion such as *synonymy* or *cognitive equivalence*, supported perhaps by a distinction between standard and non-standard property-designators, is taken to provide an adequate criterion of the identity of properties. A criterion sometimes offered in a similar spirit, *necessary* (rather than merely actual) *co-extensiveness*, is somewhat too weak to serve the purpose: it fails to distinguish geometrical properties such as *being triangular* and *being trilateral*.

A contrasting tradition considers properties to be part of the structure of the physical world and thus discoverable only through empirical enquiry, as figuring in scientific explanations, and as having in all cases causal efficacy. From this viewpoint, which we can label the *causal-nomological* one, two items might be identified as the same *physical magnitude* (to use a term of Putnam) even though conceptually distinct, and thus distinct properties, by the above standard – for example, *having a temperature of 100°F* and *having a mean molecular kinetic energy of K*, or *being blue* and *being disposed to reflect light of wavelength W under conditions C*. As can be seen, such a conception of property

serves an interest in inter-theoretical reduction. It also goes hand-in-hand with the postulation of *natural kinds* – groupings that exist in the world independent of our classificatory decisions. In this tradition, some notion such as *occupying the same causal role in nature*, or *having the same place in an ultimate scientific account of the world*, is taken as providing the right sort of criterion for identity of properties. Philosophers who primarily think of properties in this sense include Hilary Putnam, Peter Achinstein, Armstrong, and possibly Saul Kripke. Relations between the intensional conception and the causal-nomological conception are explored in depth in a recent work by George Bealer.

Properties as World Functions. In possible world semantics, attributes (in particular, properties) are often taken to be *functions* from possible worlds to sets of individuals in those worlds – intuitively, those individuals in each world that possess the property formally aimed at. Distinct properties are identified as distinct such functions; e.g. the property of *being mischievous* is the function that takes as argument any possible world and gives as value the set of things which are mischievous in that world. While obviously an advance on identifying a property with actual extensions (which, as noted before, would equate *having a kidney* and *having a liver*), this still at base extensional conception is incapable of handling distinct but necessarily coextensional properties (mentioned above). Furthermore, while such a conception is undoubtedly useful in formal endeavour, the evident presupposing of the notion of attribute needed to motivate the conception casts doubt on its prospects for illuminating what attributes themselves actually are.

Distinctions among Attributes. A number of distinctions among attributes seem both salient on reflection, and important for the proper formulation and investigation of many philosophical problems. Some of these are as follows. *Intrinsic* vs. *extrinsic* properties: the former pertain to a thing's nature, to what or how it is in itself, the latter do not. The extrinsic/intrinsic property distinction may be equivalent to that of *relational* vs. *non-relational* properties, the former being such as to involve ineliminably a relation to some further thing; e.g. *being beloved of Goethe*, *being denser than molybdenum*. The distinction between *primary* and *secondary* qualities, popularized by Locke, may be a special case of this, a secondary quality, but not a primary quality, entailing a relation to perceivers. *Categorical* (or *manifest*) vs. *hypothetical* properties: the former only concern how an object is in the actual world, the latter – e.g. modal, dispositional properties – how it is in other possible worlds as well. *Sortal* vs. *characterizing* properties: the former specify a thing's basic kind or category, e.g. *being a tiger*, while the latter are purely qualitative, e.g. *being hard*; there is a real issue as to whether the first type are analysable in terms of the second. *Simple* vs. *complex* properties: the latter are logical compounds of the former, generated through conjunction, disjunction, negation; it is unclear whether items of the second type deserve, in all cases, full acknowledgement as properties.

A particularly crucial distinction for metaphysics is that of *essential* vs. *accidental* properties: the former attach to an object in any possible world, or throughout any possible change in which the object endures, whereas the latter properties do not; essential properties are the properties a thing *must* have or retain to be the very thing it is. Unlike the other distinctions just reviewed, the status of essential vs. accidental property is one that may quite obviously be relative to particular objects. (The notion of *essence*, of course, derives from Aristotle, and was conceived by him as that which the *real definition* of an entity would provide.)

Finally, relationships between whole classes of properties, e.g. physical ones and mental ones, have been the subject of much investigation recently, with the concept of *supervenience* – a relation of grounding or determination – being a central focus.

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Aufbau-Theories

In his *Der logische Aufbau der Welt* (Berlin, 1928), Rudolf Carnap set himself the twofold task of framing a general theory of constructing (or rather, reconstructing) the objects of empirical knowledge from a certain basis and of establishing, if only in the form of an incomplete sketch, one such constructional system of the empirical world. These objectives being, of course, interconnected, the notion of an *Aufbau*-theory may be taken to cover both constructional theory as such and the various constructional systems supposed to be capable of being effected within the framework of the theory.

Carnap espouses in his *Aufbau* the view, shared by Moritz Schlick (1882–1936) and anticipated by the leading neo-Kantian Ernst Cassirer (1874–1945) in 1910, that objectivity depends not on content but on structure. Thus a constructional system must introduce its objects by purely structural descriptions. Consequently the basis of the system must comprise, besides 'ground elements', also one or more 'ground relations' supplying the domain of the ground elements with the necessary structural features. From these primitive relations, then, the other objects of the system are to be obtained by way of constructing classes and relations in ascending order. Hence the constructional method must be extensional.

Ontological theses emerge in different connections within the *Aufbau* enterprise. To begin with, there is the distinction between the concepts of constructional or empirical reality, and metaphysical reality. The question 'Is x real?' pertains to the former concept when it is answerable by constructional (empirical) means. When, on the other hand, the question asks for an answer which is independent of any constructional process or empirical verification, the concept of reality in play is that of metaphysical reality. This is reality "characterized by independence from cognizing consciousness" (§175), as Carnap puts it in a language which is due to the considerable influence of neo-Kantian idealism on his early thought. These idealistic overtones notwithstanding, the distinction at hand clearly anticipates in all essentials the celebrated distinction between internal and external questions of the later Carnap.

There is, however, an ontological differentiation also within constructional reality. The objects of a system which are introduced as classes or relations are said to be only 'quasi objects' with respect to the ground elements, which means that the name of such an entity is nothing but a 'convenient abbreviation' (§160). But this doctrine, designed to rule out any ontological commitment concerning classes and relations, is left without any genuine support. Apparently Carnap was led to it by his inclination, when speaking of reduction in his *Aufbau*, to treat a proposition about an object construed as a class or a relation of whatever order on the basis of some other objects as if it were a proposition about those other objects (see, e.g., §119); thus he may have come to think even the positing of relations as primitives to be ontologically innocent. The doctrine of quasi objects being unfounded, constructional theory is bound to give rise, for any constructional system, to a rather liberal ontology of classes and relations (Quine 1953, p. 39).

Lastly, there is to be mentioned also a certain correspondence relation that is required to hold between a constructional system and the empirical world thus reconstructed. It is postulated that the ground relations must be 'founded'; that is, they must not only be structurally isomorphic to, but actually "correspond to some experienceable, 'natural' relations" (§154). This postulate is designed to ensure that a ground relation has a counterpart in the actual world of experience. However, it amounts to an appeal to intensional contents and is thus at variance with the proclaimed extensionalism of constructional theory (Küng 1963).

The *Aufbau* project was carried further by Nelson Goodman in his *The Structure of Appearance* (Harvard, 1951). Goodman bases *Aufbau*-theory on broader foundations than Carnap had done. He loosens the adequacy criteria for constructional descriptions to structural isomorphism, and abandons the ambitious demand that a constructional system should be able to map the entire empirical world. The logic underlying a Goodmanian system may be either the calculus of classes and relations, the logic of Carnap's original *Aufbau*, or the calculus of individuals outlined by Goodman, so that a system may be either platonistic or nominalistic. Again, the basic elements of a system may be either concrete or non-concrete individuals (qualities): in the former case the system is called particularistic; in the latter, realistic. Thus the ontology of a system may be "platonistic and realistic, or nominalistic and realistic, or platonistic and particularistic, or nominalistic and particularistic" (Goodman 1951, p. 107). The system sketched in Carnap's *Aufbau* (and carefully analysed by Goodman) is according to this classification platonistic and, having 'elementary experiences' as ground elements, particularistic; whereas the system Goodman himself constructs in his book is realistic and, in conformity with his pronounced view on the topic, nominalistic.

Subsequently Goodman has extended the scope of his *Aufbau* enquiries to cover also representational systems such as works of art, and has thereby come in some respects close to Cassirer's attempt at a theory of symbolic forms. At the same time, the idealistic tendencies of *Aufbau*-theory, which Carnap believed himself to have banished by relegating idealism to what is external and hence without cognitive content, have come in Goodman's thought to the fore. In his *Ways of Worldmaking* (1978) he defends the thesis that the creation of representational systems of all sorts is a making of worlds and here he expresses more than once his basic agreement with Cassirer, Carnap's name being mentioned in the book only in connection with the 'notoriously dubious' internal/external dichotomy (Goodman 1978, p. 114).

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WERNER SAUER

Augustine

Augustine (354–430), bishop of Hippo in North Africa, exerted a lasting influence over the course of Western philosophy through the more than 100 works comprising his literary endeavour. During his nine-year-long association with the Manicheans, he embraced a world-view which was largely materialist, pantheist, and dualist. While in Milan (386), he first came into contact with Neoplatonic philosophy – Plotinus (*c.* 205–*c.* 270), Porphyry – which strictly subordinated all beings to a spiritual principle. Augustine's conversion followed shortly thereafter, and he subsequently identified the principle with the God of biblical revelation (see *Conf.* 7,21). His reading of the doxographies familiarized him with the doctrines of all the most influential philosophical schools; nevertheless, throughout his entire life he so preferred the teaching of the Platonists that,

despite an increasingly critical appraisal of them later in his life, he largely identified himself with their doctrine (see *C. Acad.* 3,20,43; *De Civit. Dei* 8,5.10–12). With their assistance he not only fought against Manichean dualism, but against other heretical and schismatic doctrines as well, and laid the foundation for his own theological thought.

Augustine was familiar with ancient philosophy's tripartite division into physics, logic, and ethics (see *De Civit. Dei* 11,25). He understood physics to be the study of the nature of things (*Philosophia naturalis: De Civit. Dei* 8,6) later referred to as ontology. He also knew that this study ontologically preceded those concerned with cognition and action, and that it occupied an undisputed position of pre-eminence, as is demonstrated in his treatment of '*res*' before '*signa*' in the *De doctrina christiana*. The essence of a thing (*res*) is either changeable or unchangeable, but being is itself virtually unchangeable: "Being is the name for the unchangeable. All things which undergo change cease to be what they were and begin to be what they were not" (*Serm.* 7,7). Such a description pertains only to God and to the divine domain. God possesses "true being, pure being, genuine being" (ibid.). Within this sphere of unchangeableness also belong those philosophical ideas which Augustine called 'unchangeable reasons' (*rationes incommutabiles*: *De div. quaest.* 46) and which were absolutely identical with God's thought. Divine attributes such as eternity, omnipotence, omniscience, etc. are derived from the unchangeableness of divine being. God alone truly exists: "he truly exists because his existence is immutable" and "in God to live, to know, to be blessed is one and the same as to be" (*De Civit. Dei* 8,6; *cf.* also *De Trinit.* 5,2,3). Augustine frequently interpreted *Ex.* 3,14 ("I am who am") in terms of the Greek philosophical conception of the purely spiritual nature of unchangeable being.

Augustine differentiated those 'intelligible things' (*res intelligibiles*) which pertained to God from other lower, but still relatively speaking ontologically superior, 'things', by designating the latter 'changeable things' (*res mutabiles*). Their existence consists in both being and non-being: "For anything whatsoever, regardless of its excellence, if it is changeable, it does not truly exist because true being does not exist where non-being exists" (*In Joann. Evang.* 38,10). One of the most significant organizing principles for Augustine's ontology is found in his pairing of the terms 'changeable–unchangeable' (*mutabile–inmutabile*) which he frequently employed within his analysis of the structure of being. Being, then, is as a matter of principle organized in accordance with a tripartite division: the corporeal which is subject to changes both in space and in time, the spiritual which undergoes only temporal changes, and the divine which undergoes no changes whatsoever (see *Ep.* 18,2).

Augustine's ontology was interwoven with his doctrine on creation. In his work *De natura boni*, a compendium of his ontology composed in 400, Augustine accepted the basic Neoplatonic position on the ontological goodness of all beings, modified it to conform to creation theology, and defended it against Manichean doctrine: "Moreover, every nature is a good in so far as it is a nature" (*De nat. b.* 1). The apex of all 'goods' is the 'unchangeable good' (*incommutabile bonum*) which Augustine identified with the Creator, the 'supreme good' (*summum bonum*). The natures of all beings are created out of nothing (*de nihilo*) and are 'goods' whether they be 'great' or 'small', 'celestial' or 'terrestrial', 'spiritual' or 'corporeal'. All 'changeable things' (*mutabilia*), beginning with those "close to the supreme good" and extending to the "very least, which are remote from the supreme good", give natures a fundamental order, the 'hierarchy of being' (*De nat. b.* 1), within which the human being, made up of an immortal soul and a mortal body (see *Serm.* 154, 10,15; *In Joann. Evang.* 19,15), occupies a middle position.

The 'changeable things' derive their existence from participation in "certain original and principal forms of things, i.e., reasons, fixed and unchangeable" which Augustine called ideas and "which are contained in the divine intelligence" (*De div. quaest.* 46,2). These, then, are "good by participation in some other good . . . the supreme good" (*De moribus eccl.* 2,4,6). This notion of 'par-

ticipation' (*participatio*) corresponds to the Platonic doctrine of μέθεξις and clarifies the relationship not only between creation and the Creator, but among created realities as well. The ontological notions of similitude (*similitudo*) and dissimilitude (*dissimilitudo*), which reveal the extent of participation in such a way as to make comparisons between individual realities possible, also give some indication as to their overall position in the hierarchy of being. Participation, then, is properly located in the sphere of the changeable as a combination of similitude and dissimilitude: "even those things which are alike by participation admit of unlikeness" (*De div. quaest.* 23). With an increase in 'similitude' comes a corresponding decrease in 'dissimilitude' and vice versa. Such a dynamic is discernible in Augustine's discussion of what he called 'goods possessed in common' (*generalia bona: De nat. b.* 3), referring to the spiritual structure of all created realities: species (*species*), form (*forma*), limit (*modus, mensura, numerus*), and order (*ordo, pondus*). One often finds Augustine grouping these notions together into triads, frequently in connection with *Wis.* 11.21 as well as his doctrine on the Trinity (ibid., *De Musica* 6.17.56; *De vera relig.* 7.13; *et al.*).

The Aristotelian notion of στέρησις (= *corruptio*), which Augustine received from Neoplatonism, made it possible for him to understand the essence of evil (*quid sit malum*) as a privation or diminution of being, and to express this in terms of these 'goods possessed in common': "evil is nothing else than the corruption of the limit, the form, or the order of a nature" (*De nat. b.* 4). The ontological ground for this 'corruption' consisted in the thoroughly negative conception of matter (*cf.* Plotinus, *Enn.* 1.8). Since it was deprived of species, form, and limit, matter was a pure nothingness, the "privation of the good, even to the extent that evil does not exist at all" (*Conf.* 3.7.12).

Just as it dominated Plotinus's monistic system, the idea of unity (*unitas, unum esse*) figured prominently in Augustinian ontology, so that the notion of unity is reflected in the multiplicity of the individually self-differentiating, changeable beings wherein each nature orientates itself to that unity. For, "whatever exists strives for unity" (*De Musica* 3,7,12).

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CORNELIUS MAYER

Aureoli. See: Peter Aureoli

Authority

Authority is partly an epistemological phenomenon, as can be seen from the fact that those who recognize the authority of a scientist or scholar regard themselves as entitled to trust his pronouncements, and on that basis make claims to knowledge. We all claim to know many things because others have spoken with authority on them, and in this respect the concept of authority is epistemological. Little attention has been paid to this kind of knowledge, first, because knowledge accepted on authority is secondary in that a person must already have knowledge from other sources, in particular, from the senses and reason, if he is to come by knowledge on authority; and epistemologists have focused upon these primary sources. Second, knowledge based on authority has often been seen as inferior, hardly to be called 'knowledge'. Perhaps this bias is based upon the doctrine ('economic epistemology') that you do not know a given proposition unless you have mixed your labour with it, and you have not mixed your labour with it if you accept it just because an authority asserted it. Additionally, authority in science and scholarship has often

been seen as a hindrance – witness the influence of Aristotle on science in the Middle Ages. Yet progress requires authority. Scientists and scholars form a community of people who can make discoveries only because they trust the reports of others in that community. No one can do everything, so each relies on others to make up for his own deficiencies. Here authority comes into its own. Without it there could be no community of scientists and scholars.

Here also authority comes into its own in the political sphere. We cannot each do everything we need to do to secure our proper ends, and certain people, political authorities, make up for our deficiencies. The authorities say what should be done and their word is accepted. Recognition of their authority is necessary for any community of more than a handful of people. This is Thomas Hobbes's view of political authority. For him an authority is one who has been authorized by many to act in the name of the many. Whenever he acts as authorized the real author of the act is the multitude who authorized him. All act through him, and in that sense he is a principle of unity, creating a community where previously there had only been individuals. This is an example of vicarious agency, action at a distance. This parallels the epistemological case in which one person does the thinking for many, a case of mental action at a distance, vicarious thinking.

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ALEXANDER BROADIE

Avenarius, Richard

Richard Avenarius was born in Paris in 1843, and studied at the University of Berlin and at the University of Leipzig, where he earned his doctoral degree in philosophy in 1868 with a dissertation presenting a psychological account of the philosophy of Spinoza. He co-founded and edited the journal, *Vierteljahrsschrift für wissenschaftliche Philosophie*, the first issue of which appeared in 1876, and which was dedicated to the proposition that all science, including philosophy, is possible only on the ground of experience. He was professor of inductive philosophy at the University of Zürich from 1877 until his death in 1896.

Because of his refusal to grant validity to any *metaphysical* entities (theoretical constructs such as *substance* and *cause* posited as intelligible beyond reference to possible experience), his philosophy is usually classified as a contribution to early German positivism along with that of Ernst Mach. He is also generally recognized as a leading proponent of the then widespread position of *psychologism*, which insisted that the empirical science of psychology must serve as the foundation of all philosophical study of logic and of knowledge generally (the position criticized prominently by Gottlob Frege and Edmund Husserl). His theory of the natural concept of the world was an important influence upon subsequent phenomenological approaches to the understanding of the world, developed by Edmund Husserl and Martin Heidegger.

For his own part, Avenarius rejected such traditional terms as empiricism and positivism because he considered his own stance as one of standing apart from all philosophical theories in order to analyse them dispassionately. Further, he found that traditional philosophical and psychological terminology was laden with misleading idealistic and sceptical connotations. In accordance with a general preference that he would rather not be understood at all than be misunderstood, he freely invented terms for key systematic concepts, which were to be understood only by their function within the system he constructed. Similarly, he coined a designation for his entire systematic philosophical position, calling it *empirio-criticism*.

His philosophy, centred on a biological-psychological account of experience, is a thorough analysis of the presuppositions underlying the natural-scientific world-view of his time. Fundamental to his account are

two axioms, one as to the contents of all knowledge, the other as to its forms.

Every human individual originally assumes, opposite himself, an environment with multiple component parts, other human individuals with multiple assertions, and what is asserted in some sort of dependence upon the environment: *all cognitive contents of the philosophical worldviews – critical or non-critical – are modifications of that original assumption.*

Scientific knowledge has no essentially other forms or means than non-scientific knowledge: *all special scientific forms or means of knowledge are developments of pre-scientific forms or means.*

Philosophy, for Avenarius, differs from other natural sciences only by its generality. Hence, his philosophical theory of experience attempts to spell out the most general and formal concepts and formulae correlating contents of asserted experiences (E-values) with component parts of the environment (R-values) on which they are assumed to be functionally (not causally) dependent. Several key scientific ideas guide his analysis. The physical principle of the conservation of energy is the basis for a general principle guiding behaviour and thought (including philosophy): 'the principle of the least amount of energy'. According to a then common biological perspective, asserted experiences have to be classified as adaptive responses to an environment which sustains and partially threatens the individual human organism involved. According to the prevailing physiological perspective, expressed experiences are directly dependent upon changes in the central nervous system, which are in turn at least partly dependent upon environmental stimuli. Avenarius's own development of the psychophysical perspective attempts to relate higher-level experiences and thoughts, and not just simple sensations, directly to underlying changes in the central nervous system.

To supplement his theory of pure experience, Avenarius also developed a historically oriented critique of experience, under the general thesis that a critical process of development was, and is still, necessary to eliminate from the prevailing concepts of experience and of the world contents that are in fact supplements to experience or deviations from the natural concept of the world.

The legendary difficulty and complexity of Avenarius's technical writing stems from several sources. His rejection of reductionism made it necessary for him to go beyond general physical principles and to include references to appropriate physiological (neurological) as well as specifically psychological considerations. However, the generality and formality of his analysis raised it high above the familiar factual spheres of the respective natural scientists. His opposition to prevailing philosophical perspectives, both those that referred to 'facts of consciousness' and those that reduced experience to simple sensations, led him to devise a terminology of his own, familiar neither to philosophical nor to scientific readers.

Perhaps paradoxically, Avenarius's defence of common human experience and its natural conception of the world was presented in an arcane system intelligible only to a few devoted students whose already formed appreciation for his penetrating thought stimulated them to work through his arduous system of analysis. For the most part, his contemporaries apparently granted him his preference: not to be understood at all.

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JOHN SCANLON

Averroes. See: **Arabic School**

Avicenna. See: **Arabic School**

B

Bacon. See: Roger Bacon

Barcan Formula

In a series of papers (*Journal of Symbolic Logic*, 1946, 1947), Ruth Barcan, later Marcus, extended some of C. I. Lewis's (1883–1964) systems of propositional modal logic to second order with identity, thus initiating quantified modal logic. Among the systems so extended were Lewis's **S4** and **S5**. Although Barcan adapted Lewis's original axiomatizations, **S4** is known to be formally equivalent to standard propositional logic plus a rule of necessitation.

(1) If $\vdash A$ then $\vdash \Box A$

and the axiom schemata

(2) $\Box (A \cup B) \supset (\Box A \supset \Box B)$
(3) $\Box A \supset A$
(4) $\Box A \supset \Box \Box A$

where '$\Box$' and '$\Diamond$' are operators for necessity and possibility.

S4, with the addition of the schema

(5) $\Diamond A \supset \Box \Diamond A$

is formally equivalent to Lewis's **S5**.

Quantified **S4** (**QS4**) and quantified **S5** (**QS5**) were obtained by extending **S4** and **S5** to include standard rules and schemata for quantification theory. To these Barcan added the schema

(6) $\Diamond (\exists \alpha) A \dashv\supset (\exists \alpha) \Diamond A$

i.e. the Barcan formula as originally stated. An equivalent of (6) is:

(7) $(\alpha) \Box A \dashv\supset \Box (\alpha) A$

Given that Lewis's symbol '$\dashv\supset$' for strict implication is defined as

$A \dashv\supset B =_{Df.} \Box (A \supset B)$

and given (1), i.e. the rule of necessitation, it follows that (6) and (7) are replaceable by the axiom schemata

(8) $\Diamond (\exists \alpha) A \supset (\exists \alpha) \Diamond A$
(9) $(\alpha) \Box A \supset \Box (\alpha) A$

respectively. Any one of (6)–(9) came to be known as the Barcan formula, abbreviated '**BF**'.

Barcan proved the converse of **BF** for **S4** and **S5** which, with **BF**, yields the equivalences

(10) $\Diamond (\exists \alpha) A \equiv (\exists \alpha) \Diamond A$
(11) $(\alpha) \Box A \equiv \Box (\alpha) A$

A. N. Prior (1956) proved that in the Barcan-style formalization **BF** is provable and hence dispensable as an axiom in **QS5**. Therefore, for **QS5** (10) and (11) are provable without a **BF** axiom.

The original Barcan axiomatizations were not grounded in a formal semantics but were informed by intuitive considerations. Those intuitions were not universally shared and the plausibility of **BF** was questioned. It appears to take us from possibility to existence as in (6).

A semantical construction was sketched by Marcus (*Synthese*, 1961) which supports the validity of **BF**. There validity is defined as truth in every model of the modal quantificational language. What is presumed in that construction is that domains are invariant across worlds. Since the actual world is among the set of possible worlds, possibilia are excluded. Marcus (*Synthese*, 1961) notes that, "If one wishes to talk about possible (non-actual) things then, of course, such a construction is inadequate". Whether a coherent account can be given of merely possible objects remained open.

Employing methods similar to those of F. S. Kanger (*Provability in Logic*, 1957), Saul Kripke (*Acta Philosophica Fennica*, 1963) presented a semantical account of quantified modal logic in which neither **BF** nor its converse are valid. Roughly, the modal operators are defined in terms of a set

of worlds ($w_1 \ldots w_n$) including the actual world and a reflexive relation R between them. $w_1 R w_2$ holds where propositions true in w_2 are possible in w_1. The characteristic **S4** axiom (4) is a transitivity condition on R. Adding a symmetry condition on R yields a semantics for **S5**. For **QS5**, R is an equivalence relation. Domains of individuals not necessarily co-extensive may be assigned to each world, and quantification is limited to the domain of each world. On such an account Kripke (1963) showed that there are counter-examples to **BF** even for **QS5** where domains of alternative worlds are not coextensive.

Given that on the Barcan-style formal basis for quantified modal logic, converse **BF** is provable in **QS4** and **QS5**, and given that Prior (*Journal of Symbolic Logic*, 1956) showed that for **QS5**, **BF** is dispensable altogether as an axiom, a revision of the formal theory was required if Kripke-style semantics was to be preserved. To that end, Kripke proposed an axiomatization which, by restricting proofs to certain sequences of closed sentences, prevents the proof of **BF** and its converse.

Prominent among alternative semantical accounts of the logical or metaphysical modalities is that of David Lewis's counterpart theory (*Philosophical Papers*, 1983). Worlds, including the actual world, are viewed as 'real' distinct individuals which have individuals as parts. No individual is a part of more than one world. Identity is a relation between a thing and itself in its world but things may have counterparts in certain alternative worlds where an appropriate relation of similarity holds. On this view, known as modal realism, sentences with modal operators are translatable into sentences which quantify over worlds. For Lewis's account the characteristic theses of **S4** (4) and **S5** (5) both fail, as does **BF**. However, converse **BF** holds.

There are further interpretations of modalities which have been explored and for which **BF** and converse **BF** have interesting consequences. For a study of **BF** on temporal interpretations see Prior (*Time and Modality*, 1957; *Past Present and Future*, 1967). A discussion of **BF** in a theory of nomological modalities may be found in A. Bressan (*A General Interpreted Modal Calculus*, 1972). For the role of **BF** in modal set theory, see Marcus (*American Philosophical Quarterly*, 1974) and Charles Parsons (*Mathematics in Philosophy*, 1983). A general survey and discussion of a range of modal systems with relation to **BF** or converse **BF** may be found in Hughes and Cresswell (1968, 1985) and Gabbay (1976).

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RUTH BARCAN MARCUS

Baumgarten, Alexander Gottlieb

Alexander Gottlieb Baumgarten was born in 1714 in Berlin, studied at Halle with Christian Wolff, was professor at the University of Frankfurt an der Oder, and died in 1762. His chief works are *Meditationes philosophicae de nonnullis ad poema pertinentibus* (1735), *Metaphysica* (1739ff.), *Aesthetica* (1750–8), *Ethica* (1751), and *Acroasis logica* (1761).

Baumgarten is a comparatively independent member of the Wolffian School. He invented the term *aesthetica* for a special philosophical discipline which he claimed to be grounded on the irreducible variety of 'sensitive cognition'. Although this new science was elaborated extensively by himself, and, in a more popular way, by his pupil G. F. Meier (1718–77), it attained no wider influence. This was mainly because it was soon rejected by Kant, who claimed a 'transcendental' – in contrast to Baumgarten's metaphysical – foundation of all science.

Baumgarten's basic argument for the existence of a special faculty of sensitive cognition leads back to the core of his metaphysics. To be aware of the material perfection of the world from a finite point of view is, he held, possible only in a sensitive way that is not overwhelmed by abstractive concepts of the intellect. For Baumgarten, beauty is the

observable phenomenon representing this material perfection, and the finite created mind is able to gain consciousness of it because of its original disposition to represent the reality and order of the world by clear but confused perceptions. Baumgarten elaborates a set of conditions for the 'art of thinking beautifully' (*ars pulchre cogitandi*). He hereby relies on the doctrines of 'special metaphysics': cosmology, psychology, and the discipline yielding the ultimate ground of the relation between these, namely natural theology.

In his account of metaphysics Baumgarten in general follows Wolff. The first main part is 'ontology' or 'general metaphysics'. This sets out the 'predicates of being'. Baumgarten interprets the principle of contradiction in a way which yields the basic ontological concept 'something' or simply 'thing' (*ens*): what is not '*A* and not-*A*', i.e. 'nothing' (*nihil*), is 'something' (*non-nihil*). The universal connection of all things is governed by the principle of *ratio* and *rationatum*: whatsoever *B* exist, is founded in something other *A*, and at the same time there is something other *C* which is founded in *B*. The further universal predicates are *unum*, *ordo*, *verum*, and *perfectum*, traditionally called the 'transcendental' predicates of being.

Baumgarten's ontology manifests much sophistication. Yet there are profound difficulties which cannot be ignored. How, for example, can the universal predicates be compatible with each member of such disjunctive predicates as: necessary/contingent; changeable/unchangeable; real/unreal; singular/universal; total/partial; finite/infinite; simple/composed; substance/accidence? The universal and disjunctive predicates constitute the internal determination of the *ens qua ens*. They differ altogether from such external (or 'relative') predicates as: similar and diverse, simultaneous, successive, cause and caused, etc. The ontological predicates then furnish the basic material for most of the arguments of special metaphysics. In two points Baumgarten proves especially his independence from Wolff: in his doctrine of monads as immaterial, inextended substances; and in his doctrine of pre-established harmony in the absence of *influxus physicus*. He herewith reinstitutes the genuine ideas of Leibniz, more than any other of the Wolffians.

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KLAUS E. KAEHLER

Becoming

The doctrine of becoming, when it is something more than just an articulation of certain asymmetries between the earlier and later 'directions' of time, attempts to make sense of the kinematic metaphors of time flowing, passing, or flying in terms of *something* that *shifts* from earlier to later times. There are well-known perplexities concerning the nature of both the *something* that does the shifting and the *shift* involved. Often it is said that it is the present or now that shifts to ever later times. This quickly leads to absurdity: 'the present' and 'now', like 'this time', are used to refer to a moment of time. Thus, to say that the present shifts to later times entails that this very moment of time – the present – will become some other moment of time and thus cease to be identical with itself! Sometimes the entity that shifts is the property of nowness or presentness. The problem is that every event has this property at some time, namely when it occurs. Thus, what must qualify some event as being now *simpliciter* is its having the property of nowness now; and this is the start of an infinite regress that is vicious since at each stage we are left with an unexpurgated use of 'now', the very term that we hoped to analyse out in terms of the property of nowness. As J. M. E. McTaggart said in his Subsidiary Argument for the unreality of time, if events undergo becoming there must be some mysterious entity *X* in relation to which they change in

respect to their pastness, presentness, and futurity, but no one has yet unearthed this *X*. The nature of the *shift* is equally perplexing, for it must occur at some rate; but a rate of change involves a comparison between one kind of change and a change of time. Herein, it is change of time that is compared to change of time, resulting in the tautology that time passes or shifts at the rate of 1 second per second, surely an absurdity since this is not a rate of change at all. C. D. Broad (1887–1971) attempted to skirt these perplexities by saying that becoming is a *sui generis* type of change that defies analysis, which puts him on the side of the mystically inclined Henri Bergson who thought that it could be known only through an act of ineffable intuition, metaphors playing only the typical mystical enabling role of being an aid to having this intuition.

To escape the clutches of both perplexity and mysticism, as well as to satisfy the demand of science to view the world non-perspectively, many have attempted a 'linguistic reduction' of temporal indexical propositions reporting an event as past, present, or future into non-indexical propositions describing a temporal relation between it and another event or time, thereby effecting an 'ontological reduction' of an event's being past, present, or future to its being respectively earlier than, simultaneous with, or later than some other event or time. It is generally conceded that such a linguistic reduction does not work, because no non-indexical proposition is identical with or entails any indexical one. The friends of becoming have drawn the wrong moral from this failure – that there is a Mr X out there doing 'The Shift'. They have overlooked the fact that two sentences can express different propositions and yet report one and the same event or state of affairs; e.g. 'This is water' and 'This is a collection of H_2O molecules', though differing in sense, report the same event – this being water being nothing but this being a collection of H_2O molecules. It could be claimed that the same holds for the appropriate use of indexical and non-indexical sentences; e.g. the tokening at t_7 of 'Georgie flies at this time (at present)' is coreporting with the non-synonymous 'Georgie flies (timeless present) at t_7', since Georgie's flying at this time is the same event as Georgie's flying at t_7, given that this time is t_7. This effects the same ontological reduction of the becoming of events to their bearing temporal relations to each other as does the linguistic reduction. The 'coreporting reduction' also shows the absurdity of the 'psychological reduction' according to which an event's being present, etc. requires a relation to a perceiver whereas an event's having a temporal relation to another event or time does not require a relation to a perceiver. Given that Georgie's flying at this time is identical with Georgie's flying at t_7, it follows that one and the same event both does and does not require being related to a perceiver!

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RICHARD M. GALE

Belief

Belief raises two main problems for metaphysics. Is some or all belief a relation to some (propositional) object? Does some belief involve a metaphysically interesting relation between the believer and an object the belief is about?

'Object of belief' is ambiguous. Suppose 'believes' is a two-place predicate. One sort of belief object is the sort of thing named by the 'that'-terms the predicate accepts, like 'that snow is white'. Most talk about propositions is talk about belief objects in this sense.

We might distinguish believing that snow is white from various psychological states in virtue of which one might have this belief. Perhaps whoever believes the proposition does so in virtue of a mental relation to an object (say, a representation) which is not itself the proposition (because the representation, but not what is believed, varies across believers). Such a view distinguishes

psychological belief objects from propositions.

An important reason for positing propositions as belief objects is that 'believes' seems to be a two-place predicate, one whose second position accepts quantified variables. Some say that by treating expressions like 'what Mary believes' as substitutional quantifiers, one can avoid commitment to propositions. A fully worked-out account on these lines, including an account of the truth of substitution instances, has never been given. Another reason for positing propositions is that mental states like belief are thought to be inherently relational, and thus to need an object (Franz Brentano, Alexius Meinong, G. E. Moore). Some functionalists challenge this.

Important reasons for positing psychological belief objects are (a) because mental states like belief are inherently computational, because of their role in directing behaviour, and because computation requires an object of computation (Jerry Fodor). (b) Since beliefs can be individuated almost as finely as sentences, a reasonable account of belief has it realized by a relation to a structured representation. Each reason has been challenged. Some functionalists deny that the behaviour-guiding role of belief requires it to be computational. Some functionalist accounts of belief identify logically equivalent beliefs, denying the fine individuation of beliefs. This last view has difficulty accounting for gaining knowledge through deduction.

Contemporary accounts of propositions usually identify them with constructions from semantic or cognitive values of sentences, or from sentences themselves. Each view has its own problems. Treating propositions as constructions from semantic values like possible worlds, individuals, or attributes seems to individuate them too crudely, with logically equivalent propositions identified, or with the proposition that Twain smoked being identified with the proposition that Clemens did. Constructions from cognitive values (Fregean senses, conceptual roles) have problems once they admit that the cognitive value of an expression may vary across individuals: If the cognitive value of 'snow is white' differs for us, it seems that we do not believe the same thing when we believe that snow is white. Constructions from expressions, if they identify propositions with what sentences say, seem to make it impossible for sentences of different languages to say the same thing.

Propositions are usually thought to be truth bearers. It has been recently suggested (David Lewis) that properties are the semantic objects of belief, i.e., the objects of belief picked out by 'that'-clauses. The motivation is to handle beliefs about the self. If each of Bob and Ray believes that he is Bob, it seems in an important sense that they believe the same thing. This can be explained by saying that their beliefs involve the self-ascription of the property being Bob. Since propositions (that snow is white) can be mapped into properties (being such that snow is white), taking properties as belief objects keeps the objects of belief of uniform type. Perry has argued that by distinguishing semantic objects of belief from psychological belief states, one can account for beliefs about the self while keeping belief uniformly a relation to a proposition.

Certain beliefs seem to be about an object in a way that others are not. If you are the winner, the belief expressed by 'you won' seems to be about you (and to relate one who has it to you) in a way that the belief 'the winner, whoever he is, won' does not. The distinction seems partially marked syntactically: 'x thinks, of the winner, that it . . .' seems to require of x that he have a belief about the winner in a sense in which 'x thinks that the winner . . .' need not.

The 'believes of . . . that it . . .' locution suggests a characterization of belief about, belief *de re* as it is usually called. If a belief is about an individual x, then the believer, x, and something corresponding to an open sentence are related in a certain way. The believer ascribes something associated with the open sentence to x. Belief about a number of objects can be said to be a matter of the believer ascribing something to a sequence of objects. This contrasts with belief *de dicto*, identified with believing a proposition. (Versions of this characterization are given by W. V. O. Quine and T. Burge.)

This leaves open questions as to the nature of what is ascribed (a predicate, a universal of some sort, etc.); the nature of ascription; whether belief *de re* is a species of belief *de dicto*; whether, more weakly, some propositions are such that believing them automatically puts one into a *de re* relation with an object.

Reducing *de re* to *de dicto* is of interest only on some views of propositions. On a Russellian view, *de re* belief may be identified with believing a singular proposition, one with an individual is constituent. Only views such as Gottlob Frege's, which limit the constituents of propositions to 'conceptual entities', are urgently in need of reduction. Some such views deny that there is an interesting distinction between *de re* and *de dicto*: one believes of x that it is F, provided, roughly, that for some concept C, x is the only C, and one believes that the C is F. A slightly more restrictive view requires that one in addition know that there is a unique C. Others require that the belief be realized by a representation which is causally related to x in one way or another.

Among those who accept singular propositions, there is little agreement as to what is necessary to believe one, and thus to have a *de re* belief. Views run the gamut from simply being able to refer to the constituents, to having a particular causal relation to them, to having a particular epistemic relation to them (perception, Russellian acquaintance).

Related to questions about belief *de re* are ones about the individuation of psychological states realizing beliefs. It has been argued (T. Burge) that some such states can be individuated only in terms of objects whose existence is logically and metaphysically independent of the believer.

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MARK RICHARD

Beneke, Friedrich Eduard

Friedrich Eduard Beneke was born in 1798 in Berlin, where he lived most of his life and was, at his death (1854), extraordinary professor. He was one of a small group of German philosophers who attempted to reformulate the Kantian philosophy in terms of a thoroughly naturalized psychology. The great problem left to philosophy by Kant was that of a deduction of the categories of theoretical, ethical, and aesthetical consciousness, which Kant had failed to exhibit as expressions of one unifying principle or encompassing structure. Three options presented themselves:

1. To accept the disunity of the categories, and hence of human life and its world. Arthur Schopenhauer (1788–1860) is the main representative of this option, which fostered Pessimism as a philosophical movement in the 19th century and is also to be associated with the 19th- and 20th-century variants of existentialism.
2. To see human consciousness as unified through some transcendental principle, as in J. G. Fichte (1762–1814), F. W. J. Schelling (1775–1854), or Hegel.
3. To attempt to perfect psychology and then derive the forms or categories of consciousness from discoverable elements and laws of the human mind – an option adopted, in different ways, by a less well-known group, including Jakob Friedrich Fries (1773–1843), Johann Friedrich Herbart, and Beneke.

Beneke professed himself a disciple of John Locke, holding that all of our concepts – including the mathematical, ethical, and ontological – are to be derived from experience. Philosophy can only build upon what is directly and fully given to us, which is exclus-

ively the present state of our own consciousness. Hence it must rest on psychology, an empirical science differing from physics in that its subject matter is inner, not outer, experience.

The specific task of metaphysics is to determine the relationship between our acts of representing and the beings which are their objects. When the objects are our own minds and mental states, they can be fully recognized for what they are in themselves. A basic Kantian error was to regard the individual soul as appearance and not reality in itself. In the soul, according to Beneke, not only do we have a being as it is in reality, but also a full presentation of substance, of causal and other grounds, and of relations, as they are without regard to appearance. The derivation of concepts of substance, causality, space, and time is most fully explained by Beneke in the first two 'Main Parts' of his *System der Metaphysik* (Berlin, 1840).

The soul presents itself to consciousness as a non-spatial and hence immaterial being, and we have no reason to think it is anything else. But, against Herbart, it is not simple. Rather it is already at its beginning a complex 'basic system' of primitive responses (*Urvermögen*) correlated with the different types of possible stimuli. Several of these types correspond to each of the senses. Interactions between stimuli and the 'basic' potentialities for response result in sense impressions, which evoke further, higher types of responses, including the most elevated theoretical, ethical, aesthetic, and religious acts of consciousness. The higher forms were held by Beneke to be neither innate nor introduced from without the mind. They develop according to the peculiar laws of the soul. The task of psychology is, in the manner of all other natural sciences, to formulate explanatory laws of consciousness on the basis of the most careful observations.

In a manner similar to Leibniz, R. H. Lotze (1817–81), and Henri Bergson, Beneke extends the main ontological concepts to the external and the social worlds – material objects and 'other' minds and social wholes – in such a way that all must possess a fundamental kinship to soul or spirit as found in the individual. He and his admirers referred to his view as 'Spiritualism'. Thus his 'naturalistic' psychology must be understood in the context of Romanticism, not in that of Positivistic Empiricism, much less Materialism. His work in psychology proper and in the theory of education was widely appreciated and of some lasting influence. Certainly the emphasis upon a broadly empirical and naturalistic approach to psychology was carried on through people such as Franz Brentano and William James, and can now be regarded as vindicated by the development of that field. But he does not seem to have adequately appreciated the difficulties facing a Lockean approach to metaphysics, which made him vulnerable to vigorous attack from the transcendentalist wing of post-Kantian thought.

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DALLAS WILLARD

Bergmann, Gustav

Gustav Bergmann was born in Austria in 1906. In 1928 he received a Ph.D. in mathematics from the University of Vienna, where one of his classmates was Kurt Gödel. After receiving his degree, he went to Berlin to work as an assistant to Albert Einstein (1879–1955). This was a result of Einstein's having invited the topologist W. Meyer (1887–1948), Bergmann's dissertation supervisor, to Berlin to work on the new unified field theory. Bergmann returned to Vienna to study law – one of his teachers was Hans Kelsen (1881–1973) – and obtained a law degree. He became the youngest member of the Vienna Circle when he was introduced into the group by his teachers and friends, Friedrich Waismann (1896–1959) and Hans Hahn (1897–1934). This led to his being influenced by the positivism of Rudolf Carnap, an influence that was to persist into

the 1940s. He left Austria in 1938 as a Jewish refugee from the Nazi era, travelling by ship to New York with a friend, the Austrian writer Hermann Broch (1886–1951). In 1939 he obtained a position at the University of Iowa as assistant to the Gestalt psychologist Kurt Lewin (1890–1947). Due to his work in mathematics, Bergmann was employed to create mathematical formulations for Lewin's 'field theory' of the mind. This experience left him with a permanent critical disdain for much of Gestalt psychology. At Iowa he met and became close friends with the American behaviour theorist Kenneth Spence (1907–67). They were to be colleagues, friends, and collaborators for many of the more than forty years Bergmann spent as a member of both the philosophy and psychology departments at the University of Iowa. Bergmann died in Iowa City in 1987.

Bergmann's early philosophical work focused on the philosophy of science, the problem of universals, the mind–body problem and the synthetic–analytic distinction. His writings in the philosophy of science were extensive and influential, ranging over such topics as "The logic of quanta", "The logic of psychophysical measurement" (with Spence), and "The contribution of John B. Watson". He advocated methodological behaviourism, while separating that view from philosophical behaviourism, a form of materialism which he rejected as a "philosophy of mind for non-philosophers". He not only repudiated materialism, but for many years adhered to a form of phenomenalism. At the same time he defended the synthetic–analytic distinction, rejected nominalism, and advocated the 'ideal language method' of analysis. Like Carnap and other positivists, Bergmann held that traditional philosophical claims were literally meaningless, but he argued that they could be *reconstructed* as ordinary statements about the structure and interpretation of an ideal language.

From the early 1950s, he concentrated on ontology and intentionality. In reflection of his rejection of a substantial self, Bergmann focused on contexts like 'it is known that this is green'. He first formulated his analysis of intentionality in "Bodies, minds, and acts", written in 1952 and published in *The Metaphysics of Logical Positivism* in 1954. Here he considers a fundamental *non-relational intentional property* and argues that an ideal language is not extensional. Taking *knowing* as such a property, he represented it by a primitive predicate that combined with a name of 'what is known'. The sentence 'this is green' was then taken to *represent* an 'awareness' and to *name* the content of this awareness – if it names anything at all. This early paper is not clear about contents and the connection of an awareness to a sentence expressing a content. To meet objections of students and others he influenced – who, as a group, were sometimes referred to as the Iowa Circle or the Iowa Realists – he modified his analysis in successive stages.

In a paper of 1955 entitled "Intentionality", he uses the sign '*M*' as a predicate to represent the primitive intentional relation 'means'. Signs consisting of sentences in single or semantical quotes are taken to be predicates representing properties of particular awareness. Such properties provide the *content* of the awarenesses exemplifying them. These awarenesses also exemplify one of a number of generic properties and are thus instances of knowing, believing, doubting, etc. In his early writings, Bergmann took simple particulars and primitive universal properties, including relations, to exist, but he did not recognize the existence of either *facts* or of a *connection* combining particulars and universals into facts. Facts did not exist, since only ultimate simples, and not complexes, were entities. Not recognizing facts, he had no need to recognize a connection that combined constituents into facts. This led him to believe that his analysis of intentionality avoided a problem faced by traditional analyses – the problem of false belief.

The relational predicate '*M*' combined quoted predicates with sentences to form further sentences like:

(B) $\ulcorner fa \urcorner M\ (fa)$

Bergmann held that (B) was a logical truth, since any sentence of the form $\ulcorner \ldots \urcorner M(\ldots)$ is true if and only if two tokens of the same sentence replace both occurrences of the dots. This is analogous to '$p \vee \neg p$' being said

to be true under uniform replacement. Taking a theme from the *Tractatus*, Bergmann held that, just as functions like disjunction and conjunction are non-existent pseudo-relations, so also *M*, being a logical relation, is a pseudo-relation that does not relate entities. Hence, whether the sentence '*fa*' is true or false, one need not ask *what* stands in the pseudo-relation *M* to the property $\ulcorner fa \urcorner$, since facts are not entities and *M* is not a genuine relation. Thus he supposedly avoids appealing to non-existent facts, while introducing a basic intentional relation.

When Bergmann came to accept facts as existents and was forced to face F. H. Bradley's concern about exemplification, he adopted a theme Bertrand Russell had used half a century earlier. He took exemplification to be a 'nexus', not a relation, just as Russell had recognized 'logical forms' of facts that were not constituents of the facts they informed. Since exemplification is a 'nexus' or 'logical relation' and not a relation among relations, Bradley's regress is supposedly blocked. But, like Russell, Bergmann now recognized 'logical' entities. The nexus *M*, like exemplification, became an entity, and, as such, it connected terms. Bergmann thus not only came to accept actual facts, but non-actual facts as well. His analysis of intentionality, which is a variant of G. E. Moore's analysis in *Some Main Problems of Philosophy*, explicitly introduced entities Moore had sought to avoid, yet implicitly acknowledged: content properties ('beliefs' for Moore) and non-existent facts. Bergmann proceeded to recognize other logical entities, connectives, and quantifiers, along with complex properties and compound facts. He thus abandoned a central claim of his early ontology; that complex signs, including defined signs, do not stand for entities.

One of the consistent themes of Bergmann's ontology was his commitment to the existence of 'bare' particulars. Following the arguments of Russell and Moore for the acceptance of numerical difference, he took the denial that particulars are complexes of universal properties, and the consequent recognition of numerical difference as distinct from conceptual difference, to be essential to the rejection of idealism. When he later acknowledged both facts and exemplification, he emphasized the 'bare' substratum as a term of the exemplification nexus and sometimes construed ordinary particulars as compound facts. As Bergmann was committed to a Russellian *principle of acquaintance*, he believed that the simple entities of his ontology must be experienced objects. Hence, he claimed acquaintance with bare substrata. Eventually he held that he was acquainted also with the universals, *particularity* and *universality*, grounding the categorial difference between particulars and universals. This was required to account for the fact that in apprehending that *a* is *f* one is aware that the particular *a* exemplifies the universal *f*, and not vice versa. His argument is similar to Russell's early argument for acquaintance with logical forms.

In his 1967 book, *Realism*, Bergmann reiterated basic ontological themes he had presented in essays over the previous fifteen years and, from the perspective they provided, analysed the ontologies of Franz Brentano and Alexius Meinong. To meet arguments directed at his acceptance of and claims of acquaintance with bare substrata, he proclaimed a 'fundamental principle of ontology': different complexes must differ in a constituent. In this book, in a 1968 paper, and in a last group of three papers published in the years 1979–81, the notion of a 'two-in-one' and a further entity, 'a circumstance', became central. He followed out the logic of the appeal to bare particulars as individuators and to the universals *particularity* and *universality*, by taking bare particulars and the 'simplest' universals to be inseparable compounds of two kinds of simples. One kind, called an 'ultimate sort' was, for example, what accounted for a universal being a non-relational universal of the first type; the other, called an 'item', was a 'mere individuator'. He spoke of two-in-ones since to take an ultimate sort and an item to be combined by a nexus to form a universal (or a particular) would initiate a Bradley-type regress. In short, as a universal cannot be taken to exemplify *universality*, he invoked a variant of the traditional grounding of necessary attributes as 'internal' constituents, while insisting that such constituents are not

connected in a complex. His notion of a two-in-one thus involved the recognition of a complex consisting only of *unconnected elements*. Bergmann used such entities to resolve a number of other, basic ontological problems. One concerned *diversity* ($\neq$) and *sameness* ($\neg \ldots \neq \ldots$). Consider a and b. They are diverse, but it is not a fact that they are diverse, in the sense that there is no further entity in which they are related by diversity. To recognize such a fact would purportedly presuppose their diversity and not account for it. Bergmann's solution is that any two entities *eo ipso* form another entity, an actual *diad* (diversity), which is a complex of the two but which contains no third connecting entity or nexus in the way in which the fact that a is f contains the nexus of exemplification. The diad's being actual grounds '$a \neq b$' as a logical truth. True claims of sameness, like '$\neg (a \neq a)$', are logically true since the diad of a and itself is not actual, but potential. Diads are one kind of circumstance. Like facts, circumstances are actual or potential, but these modes are not connected to circumstances: they pervade them.

Bergmann had held that content properties were *simple* properties, though they were represented by complex, structured signs, sentences in corner quotes. This claim was problematic in itself, but it posed a deeper problem. Content properties differ from traditional propositions in that they are exemplified by existent particular awarenesses. This fits with Bergmann's Aristotelian (rather than Platonic) realism, since he held to a *principle of exemplification* according to which only exemplified universals exist. But his original rule for forming primitive content predicates provides a description of a content property for every sentence and implies that such a property exists, whether or not it is exemplified. The problem stems from his use of complex structured signs as primitive predicates, while taking primitive predicates, on his reference theory of meaning, as mere labels in an ideal language. To resolve the problem Bergmann replaced his structured predicates by standard primitive predicates. This brought into prominence another problem.

Bergmann appeared to give some substance to his claim that sentences like (B) were analytic truths by the use of the *same sentence* within and without corner quotes. Employing a primitive predicate like 'ϕ' in place of a quoted sentence he replaced (B) by:

(C) $\phi\ M\ (fa)$.

But Bergmann can hardly claim that (C) is true in virtue of its form, since the analogy with '$p \vee \neg p$' is lost. This led him to claim that (C) was logically true in virtue of an entity, an actual *meaning circumstance*, which, like the actual diad $[a,b]$ (which is the ground of '$a \neq b$' being a logical truth), contains no nexus. Representing an actual meaning circumstance, (C) is a logical truth. Just as he had once claimed that M was a pseudo-relation, however, so in his last works Bergmann declares M and $\neq$ to be 'literally nothing' and, hence, not constituents of diads or meaning circumstances. The actual meaning circumstance grounding the analyticity of (C) contains only ϕ and fa. By contrast, where $g \neq f$, '$\phi\ M\ (ga)$' is logically false, since the meaning circumstance composed of ϕ and ga is potential only. Circumstances thus furnish an ontological ground for logical truth and falsity and purportedly resolve a problem Bergmann had introduced along with M: the need for an analysis of analyticity encompassing 'M'-contexts. But his ontology developed a baroque complexity and violated his fundamental principle of ontology since it came to include diverse complex entities that did not differ in a constituent: the diad *and* the meaning circumstance composed of ϕ and fa, for example.

A further ontological problem Bergmann focused on in his last years concerned the analysis of relational order in facts. Like Russell, he saw the need to distinguish between facts like aRb and bRa. He did so by using diads and adapting Kazimierz Kuratowski's procedure. Like sets, diads are unordered. Since any two entities form a diad, we have complex diads like $[a, [a, b]]$ and $[b, [a, b]]$. Bergmann takes binary relations to be monadic properties of such diads and analyses a fact like aRb in terms of one of the complex diads, while analysing bRa in terms

of the other. This follows the familiar Kuratowski procedure that supposedly analyses an ordered entity in terms of an unordered entity. As diads are generated *ad infinitum*, they provide an infinite domain and permit a set-theoretical analysis of elementary arithmetic without an infinity axiom. However, a question arises as to whether diads are sets by another name.

Bergmann vigorously opposed prevalent contemporary themes – nominalism; materialism; the substitution of formal questions and techniques for philosophical problems and analyses, whether by followers of W. V. O. Quine, of Carnap, or of Alfred Tarski. He opposed the pragmatic idealism of the tradition of John Dewey (1859–1952) and the ordinary language movement's dismissal of philosophical problems. As a reflection of his commitment to what he called 'the tradition', he wrote several illuminating studies of major figures, including William Ockham, Nicolas Malebranche, Leibniz, Edmund Husserl, Brentano, Meinong, Gottlob Frege, Russell, Moore, and Ludwig Wittgenstein. Writing in a dense but vigorous and polemical style, he coined memorable phrases, and when he wrote of the 'linguistic turn', he formulated a phrase that entered the vocabulary of his time and characterized the philosophical era to which he belonged and contributed.

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HERBERT HOCHBERG

Bergmann, Hugo

Hugo Bergmann (Shmuel Hugo Bergman) was born in 1883 in Prague and died in Jerusalem in 1975. He was one of the founders of philosophy in Israel. During his schooldays in Prague (1889–1909) he had been a classmate of Franz Kafka (1883–1924), together with whom he started to study chemistry. Soon Bergmann turned to philosophy, mathematics, and physics. His teacher in philosophy was the Brentanist Anton Marty. Thus Bergmann was trained in descriptive psychology and also came in close contact with Franz Brentano himself.

From 1898 on, Bergmann was already a strong partisan of Zionism. His first (anonymous) publication of 1903 was "Die Judenfrage und ihre Lösung". From 1914 to 1918 he served as an officer in the ranks of the Austrian army. In 1920 he emigrated to Palestine, where he became the first director of the Jewish National Library in Jerusalem. From 1928 on he lectured in philosophy and in 1935 he was elected as the first rector of the Hebrew University. Together with Nathan Rotenstreich he translated the three critiques by Kant and played a leading role in the development of a philosophical terminology in modern Hebrew. His bibliography embraces more than 2000 items. Along with Rotenstreich, his students included Joseph Agassi, Yehoshua Bar-Hillel (1915–75), and Gershon Weiler.

Bergmann's Ph.D. thesis on the atomic theory in the 19th century confirms his early interest in the philosophy of science. His first book *Untersuchungen zum Problem der inneren Wahrnehmung* (Halle, 1908) is concerned with a central problem of descriptive psychology, defending Brentano and Marty against critics such as Alexius Meinong, Hans Cornelius, and Edmund Husserl. Inner perceptions, according to Bergmann, present to the perceiver an intuitional content in such a way that this is evident to him. Because inner perceptions are not immediately directed to concepts, however, our experience in this respect is incommunicable and therefore private.

Bergmann argues for Brentano's thesis that 'evidence' in relation to inner perception means the absence of error (*'Irrtumslosigkeit'*). Like Marty, however, Bergmann rejects the idea of immanent objects as objects of thinking.

Bergmann was the first of all the members of the Brentano School who provided a

critical exposition of Bernard Bolzano. His book of 1909, entitled *Das philosophische Werk Bernard Bolzanos*, gives an overview of Bolzano's method, logic, psychology, aesthetics, ethics, and metaphysics, emphasizing Bolzano's objectivism as well as his historical background in Leibniz and Stoic logic. Bergmann also criticizes Bolzano, especially his conception of ideas as such, and the missing relation between propositions as such and judging subjects. He rejects the concept of false propositions in themselves and calls this the 'basic error' of Bolzano.

Moving away from his earlier (Brentanist) views, Bergmann is by 1929 insisting on the impossibility of a proof of a general law of causality. See his *Der Kampf um das Kausalgesetz in der jüngeren Physik* (Brunswick, 1929, with a preface by Albert Einstein). Drawing on neo-Kantian conceptions, he describes the 'law of causality' as a methodological and transcendental condition for a symbolic interpretation of facts. Conceptual components always transcend observational data.

The writings of the later Bergmann were concerned mainly with the philosophy of religion and humanism, united by what he called 'dialogical philosophy'.

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RUDOLF HALLER

Bergson, Henri

Henri Louis Bergson was born in 1859 in Paris, where he died in 1941. He studied at the École Normale Supérieure under Emile Boutroux. From 1882 to 1897 he taught at lycées in Angers and Clermont-Ferrand and then in Paris. From 1897 to 1921 he pursued a highly successful career at the Collège de France. His lectures, delivered to overflowing halls, attracted international audiences. In 1918 he was elected to the Académie Française and in the same year was received into the Légion d'honneur. Serving from 1922 to 1925 as chairman of the League of Nations International Commission for Intellectual Co-operation, Bergson was awarded the Nobel Prize for Literature in 1928.

Originally a disciple of Herbert Spencer (1820–1903), Bergson was led by his analysis of the former's concept of time to give up Spencer's mechanistic philosophy. According to Spencer, time is comprised of instants and can be adequately described by numerical units (seconds, minutes, etc.). But, Bergson discovered, such concepts are patently inadequate when confronted with experience – particularly the experience of our inner selves. The moments of our psychological time, far from exhibiting sharp breaks or series of instants, shade into each other continuously, while each moment is unique – is qualitatively different from every other. The more deeply we probe into this inner duration, the more we discover a self which endures, and whose free acts escape both quantification and prediction.

Bergson's distinction between qualitative inner duration and quantitative (clock) time is first explored in *Time and Free Will* (1890) and is later applied by him to ever broader reaches of experience. In *Matter and Memory* (1896) he develops a mind–body dualism which depicts mind and body as interacting modes of duration. In *Creative Evolution* (1907) he proposes an anti-mechanistic evolutionary theory which opposes the creative process of life, with its ceaseless production of new forms, to the entropy of matter. In *The Two Sources of Morality and Religion* (1932) he describes human history as a struggle between the 'open' and the 'closed' society, a struggle in which religious experience plays an essential role.

The many contrasts typical of Bergson's philosophy (inner duration/clock time, memory/matter, life/entropy . . .) have often been presented as sharp dualisms expressing unresolved conflicts. It is more accurate, however, to view these contrasts as involving a dialectic between two tendencies, one expansive and creative, the other conservative and mechanizing. Without the mechanizing

tendency, the creative tendency could not develop.

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PETE A. Y. GUNTER

Berkeley, George

George Berkeley (1685–1753) was born in Ireland, near Kilkenny. He studied at Trinity College, Dublin, where he received his BA in 1704, and became a fellow in 1707. Having moved to London and travelled extensively on the Continent, he was made dean of Derry in 1724, and gave up his fellowship. Berkeley's plan of founding a college in Bermuda to benefit not only white settlers, but also Indians and blacks, took him to Newport, Rhode Island, with his young bride. When the plan aborted through lack of the funds promised by Parliament, he returned to England, having influenced colonial intellectual life in a stay of three years. After his 1732 return to London, he was appointed bishop of Cloyne, in 1734. His most important and influential works are *Essay Towards a New Theory of Vision* (1709), *A Treatise Concerning the Principles of Human Knowledge* (1710), and *Three Dialogues Between Hylas and Philonous* (1713).

Berkeley attacked atheism, which he connected with materialism. To both godless standpoints he opposed a doctrine brilliant in its simplicity and coherence. The very notion of matter existing in itself is for Berkeley incoherent (see *Principles* §§16 and 17). Such matter would be incapable of grounding through its primary qualities alone the powers to affect perceivers which allegedly constitute its secondary qualities. Primary qualities cannot be present without colour or some other qualities of content, yet these can be present only 'in the mind', through being perceived (cf. *Principles* §§3, 4, 14, and 15). The most directly evident, palpable, concrete presence of qualities in reality is their presence in experience or imagination. But, again, qualities are never thus present except in certain minimal clusters. It is a fallacy to suppose a quality present in 'abstraction' from such a cluster. So one cannot find triangularity truly present to the mind (in experience or imagination) abstracted from every distribution of angle measures. Nor can one find triangularity (even with a specific distribution of angle measures) in abstraction from all colour contrast.

If we could find a clear relation between material substrata on one side and qualities sensed directly such as colours on the other, *then* according to Berkeley we could legitimately accept substrata indirectly, by means of such a relation. But if we are told that the snowball itself or its matter 'supports' the whiteness which we sense directly, what is the nature of such 'support'? It is not the support that a roof may derive from columns. What 'support' then is it? 'Exemplification' must be rejected, Berkeley claims; but such rejection must not be *ad hoc*: hence the need for a global rejection of such a nexus as meaningless, a rejection self-evidently warranted for Berkeley, but defended anyhow, frequently and variously (cf. *Principles* §§16–17).

Moreover, even if matter were comprehensible, it would be unknowable (§18). We don't know that there is any matter by the senses, since what we sense directly is only ideas or sensations. And we don't know that there is any by reason, since there is no necessary connection between such matter and our ideas or sensations (cf. §§86–7). What is more, even if matter were comprehensible, the postulation of existing matter would not help at all to explain how we come to have our ideas and sensations, since by hypothesis matter is inert. The will serves Berkeley as model of true causation, which he opposes to mere correlation; but only spirits have will-power. Matter therefore could be said to enter at most into true correlations; but even this could hold only if it were knowable or so much as comprehensible. Since, however, no aggregation of matter could ever be a spirit, it could never be

an explanatory causal source of anything, which makes it unknowable by causal or explanatory inference.

In denying the substantiality of matter, Berkeley does not reject the commonsense world of sticks and stones, houses, and mountains. On the contrary, his wish to defend that world, and our immediate perception of it, is precisely what leads him to reject the etiolated matter of Lockean realism. The world of colours and textures and sounds is held close by Berkeley while he pushes away the thin and formal underlying reality of imperceptible particles. In its stead he favours a divine underlying reality wilfully imposing its order on our world of immediate appearance.

Several important advantages ensue (some in effect listed in *Principles*, 85, and in the *Dialogues*, 257–8; see also *Principles*, 86, and 88, re skepticism). The following two deserve emphasis. First, one avoids the problems of mind–body interaction that burden the dualist. Second, one removes a problem among the deepest and most intractable in all philosophy, one that bedevils subsequent philosophy to our own day: that of how to explain the possibility of our thought about the world (intentionality) in terms ultimately of how the world is in itself (the facts). Berkeley of course reverses the question, since for him reality is fundamentally thought, experience, and will; and it is the so-called objective (including the natural) that needs explaining by reference to the subjective, to spirits and their perceiving or understanding of ideas, and their willing of such, etc.

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ERNEST SOSA

Biology

The ontology of biology is approached best by considering a (perhaps *the*) central organizing theory of that discipline – the theory of evolution. Evolution is the process of descent with modification. Life on earth originated from non-life about four billion years ago. It is thought that all organisms now on earth are related; although multiple originations are conceivable, the universality of the genetic code (as well as other evidence) suggests that a single origin is more likely.

The history of life can be described in two ways. Characteristics change within species; and new species come into existence (and old ones go extinct). Roughly corresponding to these two aspects of the evolutionary process, there are two areas of enquiry within evolutionary theory. *Microevolutionary* theory studies the change in frequency of characteristics that occurs within populations. *Macroevolutionary* theory studies the origin of species and higher taxa.

Charles Darwin (1809–82) aspired to unite these two evolutionary phenomena within a single framework: evolution *by natural selection* changes the characteristics found *within* a population. This process, carried out over longer reaches of time, eventuates in the existence of variation *among* populations. A single species may give rise to daughter species by the isolation of a subpopulation from the parent; if the isolated subpopulation and the parental population experience different selection pressures, they may in time evolve numerous differences in morphology, physiology, and behaviour. The result may be that there are *two* populations that cannot exchange genetic material. Biologists would then count the branching event as the birth of a new species.

The speciation process just described has two features:

1. The daughter was geographically isolated from the parent *before* divergent character evolution took place (allopatry).
2. Organisms in the parent and daughter species reproduce sexually.

This sufficient condition for the origin of species is generally thought not to be necessary; neither the temporal order described in (1) nor the requirement of sexuality in (2) is required.

Darwin's theoretical unification of microevolution and macroevolution is now the received view, although vigorous challenges to 'neo-Darwinism' are to be found. These take the form of additions to Darwin's basic picture, or of subtractions therefrom. The idea that all life is related is not in question; rather, it is Darwin's picture of the evolutionary *process* that has received theoretical elaboration and challenge.

Darwin conceived of natural selection as a struggle among *organisms*; a characteristic will increase in frequency within a population if it confers on the organisms possessing it an advantage over those organisms who do not possess it. Darwin viewed selection as *individual* (or *organismic*) selection. He also held that this form of selection is not just an occasional phenomenon in the history of life; Darwin maintained that it is the *principal cause* of the diversity we now observe.

Ever since Darwin, evolutionary theory has debated the emphasis that Darwin placed on organismic selection. Are there characteristics found in nature that cannot be explained by this causal mechanism? The idea of adaptations above the organismic level has waxed and waned. Apparently *altruistic* characteristics pose a problem for organismic selectionism. Altruistic characteristics are advantageous to the group in which they occur, but deleterious to the individuals in the group that possess them. Individual selection should lead such characteristics to give way to more *selfish* traits. On the other hand, if groups compete against other groups, groups containing altruists will do better than groups of selfish individuals.

The majority view in evolutionary theory now is that the kind of group selection required to evolve and maintain an altruistic characteristic will rarely occur. The idea is that the traits found in nature will usually be ones that exist because they are good for organisms, not because they are good for groups. The 'good of the species' is viewed as a suspect term, one which evolutionary biologists now mainly eschew.

Besides considering objects *above* the level of organisms, evolutionists have also asked whether selection can occur *below* the level of the individual. The idea that selection acts fundamentally on *genes* came into vogue in the 1960s and 1970s. It was not clear, initially, whether this was intended as an alternative to the idea of organismic selection, or as a better way of describing the idea of organismic selection. The idea of genic selection is here taken in the former sense.

It is a striking fact about the genome (i.e. the total complement of genes an organism possesses) that much of it has no known function, as far as the construction of the organism's phenotype (i.e. the organism's traits of morphology, physiology, and behaviour) is concerned. Perhaps future research will uncover a function; but as of now the hypothesis appears plausible that there is a good deal of 'junk DNA'. A process of *genic selection* seems to occur at the genetic level, whereby genetic elements that are better able to spread through the genome increase in frequency. This is a selection process in which the survival and reproduction of organisms plays no role.

Another gene-level process is the neutralist theory of evolution, which holds that much of the genetic variation we observe is due to chance substitutions, not to selective differences. This idea is often described as a supplement, rather than a challenge, to the idea of organismic selection. A good deal of *genetic* variation is explained by neutralism, whereas *phenotypic* variation may be principally due to natural selection.

All the processes just described aim at explaining the emergence of characteristics within populations or within ensembles of populations. But, as noted above, evolutionary theory also tries to account for why new species and groups of species come into existence. Why are there so many beetle species? This question differs from asking why there are so many beetles. Are patterns of species diversity due to chance? Or to the workings of individual selection (wherein a species goes extinct because the organisms in it perish in the struggle for existence)? Or

is there some non-random causal mechanism at work above the level of individual organisms?

The fundamental ontological distinction deployed in the above description of evolutionary theory is that between *object* and *property*. The objects considered – genes, organisms, species, higher taxa – come into existence and eventually exit from the scene. The resulting pattern in the tree of life is to be explained by the properties that those objects possess. The generalizations of evolutionary theory quantify over both objects and properties – for example, the thesis that evolutionary altruism is rare claims that *traits* that are good for the group but bad for the individual possessing them will be selected against.

The nature of the objects and properties that form the ontology of biology are, of course, under continuing scientific and philosophical scrutiny. In fact, evolutionary theory can even displace an item from one side of this dichotomy to the other. Pre-Darwinian biology viewed species as natural kinds, but evolutionary theory has led many biologists (Michael Ghiselin and Ernst Mayr, for example) and philosophers (for example, David Hull) to think of them as individuals – i.e., as integrated and cohesive physical objects that come into existence and pass away.

The teleological/functional language deployed by the theory of evolution is entirely consistent with physicalism. No *élan vital* is required for the origin and maintenance of adaptations. At the same time, the *supervenience* of biological properties – for example, fitness, predation, and sexuality (indeed, the property of being alive itself) – on physical properties implies that the laws of evolution cannot be reduced to physical laws (assuming that such reducibility requires type-identity statements as bridge laws).

For example, the theory of natural selection employs the concept of fitness, but fitness is not identical with any single physical property. This is because the physical properties responsible for a zebra's fitness may be entirely different from the physical properties responsible for the fitness of a cockroach. If reducing the theory of natural selection to a physical theory requires that fitness be identified with some physical property, reductionism fails.

Evolutionary theory describes a hierarchy of objects from genes up to higher taxa; it poses questions about the importance of various causal processes that can arise within that hierarchy. Although each object can be viewed as a physical thing, fruitful theorizing about biological processes frequently abstracts away from physical details, the goal being to identify informative generalizations that unite physically diverse objects within a single biological framework.

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ELLIOTT SOBER

Boethius

Anicius Manlius Severinus Boethius was born into a wealthy patrician family in Rome (*c.* 480). He was known during his own lifetime as a brilliant scholar and had a distinguished political career under the Ostrogothic king Theodoric. He was accused of treason in 523 and imprisoned at Pavia until his execution (*c.* 524).

Boethius's scholarly career was guided by his commitment to preserving and making accessible to his Latin contemporaries the great philosophical achievement of ancient Greece. Though he expressed the intention of translating and commenting on all of Plato and Aristotle, nearly all of his work of this sort was devoted to Aristotle's *Organon*. His extant works include translations of Porphyry's *Isagoge* and Aristotle's *Categories*, *De interpretatione*, *Prior Analytics*, *Topics*, and *Sophistici elenchi*; and two commentaries on the *Isagoge* and *De interpretatione*, and one on the *Categories*. We have only his notes for the commentary on the *Prior Analytics*; his translation of the *Posterior Analytics* and his commentary on the *Topics* are lost. He also commented on

Cicero's *Topica*. His own treatises on logic are *De syllogismis hypotheticis*, *De syllogismis categoricis*, *Introductio in categoricos syllogismos*, *De divisione*, and *De topicis differentiis*.

Boethius considered logic an intellectual discipline in its own right but also an essential tool for other intellectual disciplines. In four of his five theological treatises (*De Trinitate*, *Utrum Pater et Filius*, *Quomodo substantiae*, and *Contra Euthychen et Nestorium*) he shows its instrumental value for Christian theology by using Aristotelian logic, particularly the doctrines of the categories and predicables, to clarify and resolve theological issues. *De Trinitate*, for instance, includes a historically influential discussion of the Aristotelian categories and the applicability of various kinds of predicates to God.

Boethius shared the common Neoplatonist view that Plato and Aristotle could be harmonized by following Aristotle in logic and natural philosophy and Plato in metaphysics and theology, and the theological treatises show his development of Aristotelian logic within the framework of Platonist metaphysics. He distinguishes two kinds of forms: forms that are conjoined with matter to constitute bodies – he calls these 'images' (*imagines*) – and forms that are pure and entirely separate from matter – he calls these 'true forms' and 'the forms themselves'. The former, enmattered forms, depend for their being on the latter, pure forms.

These three sorts of entities – bodies, enmattered forms, and separate forms – are the respective objects of three different cognitive activities which constitute the three branches of speculative philosophy. Natural philosophy is concerned with enmattered forms as enmattered, mathematics with enmattered forms considered apart from their matter (though they cannot be separated from matter in actuality), and theology with the pure and separate forms (see also his first commentary on the *Isagoge* I, 3 and *De consolatione philosophiae* V, Prose 4). Boethius thinks that the mental abstraction characteristic of mathematics is important for understanding the Peripatetic account of universals (see his second commentary on the *Isagoge* I, 10–11): the enmattered, particular forms found in sensible things can be considered as universal when they are considered apart from the matter in which they inhere (though they cannot actually exist apart from matter).

His last and most famous work, *De consolatione philosophiae*, contains discussions of the nature of human happiness and the good (Book III); the problem of evil (Book IV); providence, fate, and chance (Books IV–V); and the apparent incompatibility of divine foreknowledge and human free choice (Book V).

Boethius's work was extremely influential for philosophy in the Middle Ages. Until the recovery of the works of Aristotle in the mid-12th century, medieval philosophers depended almost entirely on Boethius's translations and commentaries for their knowledge of pagan ancient philosophy, and his treatises on logic continued to be influential throughout the Middle Ages. The preoccupation of early medieval philosophers with logic and with the problem of universals in particular is due largely to their having been tutored by Boethius. The theological treatises also received wide attention in the Middle Ages, giving rise to a commentary tradition extending from the 9th to the 13th centuries.

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SCOTT MACDONALD

Bolzano, Bernard

Bernard Bolzano was born in Prague on 5 October 1781, son of a German mother and an Italian father, and died there on 18 December 1848. He studied philosophy, mathematics, physics, and theology at the Charles University in Prague, graduated for the Ph.D. and was ordained a priest in 1805, and became the permanent holder of a newly

founded chair in the science of religion at the university in 1806. Owing to his public criticism of the Austrian constitution and the expression of certain pacifistic and socialistic opinions, he was dismissed in December 1819. From 1823 to 1841 he composed his two main works, the *Wissenschaftslehre* (Sulzbach, 1837, in four volumes) and the posthumous *Größenlehre*. Bolzano's ontology influenced Edmund Husserl's philosophy and had an indirect influence on the logical semantics of the Warsaw school. Furthermore, his conception of ethics and social philosophy exerted a certain impact on important personages of the cultural life of Bohemia, and via his pupils and friends his ideas had an appreciable effect on the development of the Austrian system of education.

Already in the course of his early logical and mathematical studies Bolzano had come to realize that there is a profound distinction between the actual thoughts and judgements (*Urteile*) of human beings, their linguistic expressions, and the abstract propositions (*Sätze an sich*) and their parts which exist independently of these thoughts, judgements, and expressions. The difference between real things (*wirkliche Dinge*) existing concretely in space and time and abstract objects which exist beyond space and time is a fundamental ontological distinction in Bolzano's philosophy. In his terminology, real things have subsistence (*Dasein*) whereas abstract objects have logical existence bare of subsistence.

The first basic notion of Bolzano's ontological system is the part relation. Its domain – i.e., the set of all objects bearing it to something – embraces concrete substances, abstract objects, and collections (*Inbegriffe*). The converse domain of the part relation – i.e., the set of all objects to which it is borne – contains collections only.

Some collections are concrete sums existing in space and time, the rest are sets (*Mengen*) or abstract sums. Concrete sums are composed of substances and adherences – i.e., forces. Forces applied to certain substances give rise to subjective ideas (*subjektive Vorstellungen*), thoughts, or judgements. Further results of such applications are the concrete sentence-occurrences. A subjective idea is a part of a judgement which is not itself a judgement. The set of judgements is ordered by a causal relation.

Bolzano's abstract world is constituted of sets, abstract sums, ideas-as-such (*Vorstellungen an sich*), certain properties (*Beschaffenheiten*), and objects constructed on the basis of these entities. Thus, sentence shapes are a kind of ideas-as-such, and certain complexes of ideas-as-such constitute propositions. Ideas-as-such can be generated from expressions of a language by means of axioms for the relation of being an object of something. Analogously, properties can be generated by axioms for the relation of something being applied to an object. The converse of this relation – i.e., the relation of an entity having a property, and the relation of being an object of an idea-as-such are fundamental ontological constants for Bolzano.

Natural numbers are defined by Bolzano as properties of bijective sets, and real numbers are essentially conceived of as properties of sets of certain infinite sequences of rational numbers. The analysis of infinite sets leads to a generalization of the part relation by scrapping the Euclidean doctrine that the whole is always greater than any of its parts. The extension of the linear continuum of finite numbers by infinitesimals within the coarsest algebraic filter settles definite limits to Bolzano's approach to non-standard analysis.

A part relation in a narrower sense, namely the relation of being a subsequence of a sequence of abstract objects, holds among ideas-as-such and propositions. Furthermore, the relation of derivability (*Ableitbarkeit*) holds among propositions, and true propositions are ordered by the relation of entailment (*Abfolge*).

A proposition in Bolzano's sense is a pre-existent sequence of ideas-as-such. Only propositions containing finite ideas-as-such, however, are accessible to the human mind. Hence, apprehensible propositions are pre-existent finite sequences and in trying to define them one must forbear referring to a recursive method of construction with its implicit conception of a potential infinity.

Among the relations holding between the constituents of the concrete world and the

may be called a *contuition* of the eternal reasons which guide the mind in the act of judgement.

Body–Soul Relation. Although Bonaventure accepted Aristotle's principle that the soul is the form of the body, he saw the relation between soul and body differently, since the soul itself has a hylomorphic structure. This enabled Bonaventure to conceive of the soul, its dignity, and its eternal destiny differently from the strictly Aristotelian position. While the Aristotelian form would cease to exist when the human person dies, the Bonaventurian soul can be thought to have a natural desire for the perfect happiness which Christianity believes to be its ultimate goal and hence as having a natural immortality.

Bonaventure's work helped to consolidate the opposition to radical Aristotelianism and gave rise to a short-lived neo-Augustinianism among Franciscan scholars in the late 13th century. While his philosophical positions were soon superseded by the more Aristotelian orientation of John Duns Scotus, his influence as a master of the spiritual life has been extensive, especially in the German-speaking lands of Europe.

The critical edition of Bonaventure's works published as *Opera omnia*, ten volumes (Quaracchi, 1882–1902), remains the most reliable Latin edition.

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ZACHARY HAYES

Boolean Algebra

A *Boolean algebra* is a domain of objects for any one of which, say X, a unary operation * yields another object $^*X$ of the domain as its 'complement', and for any two of which, say Y and Z, two binary operations $\sqcap$ and $\sqcup$ yield objects $Y \sqcap Z$ and $Y \sqcup Z$ of the domain, which among its objects contains also two constants 0 and 1, and all of whose objects satisfy the axioms

(1) $X \sqcap X = X$
(2) $X \sqcap Y = Y \sqcap X$
(3) $X \sqcap (Y \sqcap Z) = (X \sqcap Y) \sqcap Z$
(4) $X \sqcap (Y \sqcup Z) = (X \sqcap Y) \sqcup (X \sqcap Z)$
(5) $X \sqcap 0 = 0$
(6) $X \sqcap 1 = X$
(7) $X \sqcap {}^*X = 0$,

as well as the further axioms (1′)–(7′) arising from (1)–(7) by interchanging $\sqcap$ and $\sqcup$, and 0 and 1. (This axiom system is a convenient, but not an independent one.)

Example 1: The two-element set $\{\bot, \top\}$, the constants $\bot$ and $\top$ acting as mutual complements, ${}^*\bot = \top$, ${}^*\top = \bot$, with operations $-$, $\triangle$ and ∇ defined like *, $\sqcap$ and $\sqcup$ by axioms (5)–(7), (5′)–(7′). The importance of this minimal non-trivial domain appears from the fact that any equation $f(c_1,\ldots,c_n) = 1$ (where the expression on the left is built up from constants and/or variables by complementation, addition or multiplication), if true in $\{\bot,\top\}$, is true in *all* Boolean algebras and therefore derivable from the axioms for Boolean algebras. Moreover, the interpretation of $\bot$ and $\top$ as truth-values 'True' and 'False' and of $-$, $\triangle$ and ∇ as negation $\neg$, conjunction &, and adjunction v, respectively, establishes a connection with classical propositional logic.

Example 2: The power set (i.e. the set of all subsets) of a given set S where the latter acts as 1 and the empty set as 0, and the operations are set-theoretic complementation C, intersection $\cap$ and union $\cup$.

Example 3: Any sub-algebra of the power set algebra of Example 2, i.e. any system of subsets of S which contains S as well as the empty set and is closed with respect to set-theoretic complementation, intersection, and union (take the latter as the required algebraic operations, the empty set as 0 and S as 1). According to a representation theorem due to M. H. Stone (1935, "Postulates for Boolean algebra and generalized Boolean algebras", *American Journal of Mathematics*,

57, 703–32), every Boolean algebra is isomorphic to a field of sets of this kind.

Example 4: The set of all propositions of a theory T is partitioned into classes of equivalent propositions by defining the class of propositions equivalent to a given proposition p by $|p| = \{x: \vdash x \leftrightarrow p\}$ (where '$\vdash x \leftrightarrow p$' means that $x \leftrightarrow p$ is a theorem of T). With complementation, intersection, and union defined by $^*|p| = |\neg p|$, $|p| \cap |q| = |p \,\&\, q|$, and $|p| \cup |q| = |p \vee q|$, the classes of equivalent propositions of a classical, i.e. two-valued theory T form a Boolean algebra, the Lindenbaum (-Tarski) algebra of T, with the class of all theorems of T as 1 and the class of all contradictions of T as 0. Extensions of the concept of a Lindenbaum algebra for quantificational logic lead to polyadic algebras and related concepts of algebraic logic (see Thiel 1984 for a short survey).

Example 5: If relations are viewed extensionally, so that a binary relation R in a set M is a subset of $M \times M$ (i.e., a set of ordered pairs $\langle x,y \rangle$, x and y members of M), and two binary relations R and S are considered as identical if $xRy \leftrightarrow xSy$ holds for all x, y of M, then the set of all relations in M is a Boolean algebra with respect to complementation $^*(xRy) = \neg(xRy)$, logical multiplication $xRy \cap xSy = xRy \,\&\, xSy$, and logical addition $xRy \cup xSy = xRy \vee xSy$ (in fact, this is the power set algebra of $M \times M$, cf. Example 2). It remains a sub-algebra of the relational algebra we get by taking into account, additionally, the operations of conversion $^cR = yRx$, relative multiplication $xR;\, ySy = (\exists z)\,(xRz \,\&\, zSy)$, and relative addition $xRy + xSy = (\forall z)(xRz \vee zSy)$. Algebras of relations (binary or, more generally, n-ary) are among the fundamental structures of the older algebra of logic, now absorbed by algebra (as a mathematical discipline), metamathematics, and algebraic logic.

Boolean logic has its origin in the early 19th century's growing interest in the purely formal side of the laws governing different number systems, of methods for the solution of differential equations, and of pure algebra, culminating in the development of a 'symbolical algebra' many features of which became paradigmatic for 'symbolic logic'.

Although many pertinent ideas can be found in some logical fragments of Leibniz (not published before 1840), the first 'algebra of logic' was created neither by him nor by George Boole (1815–64), but by Augustus De Morgan (1806–71), even though later developments normally referred (often critically) to Boole's *An Investigation of the Laws of Thought on Which are Founded the Mathematical Theories of Logic and Probabilities* (London: 1854). While Boole in *The Mathematical Analysis of Logic* (1847) had aimed at expressing the traditional Aristotelian logic by algebraic means, he states its real achievement in "The calculus of logic" (1848) as "the application of a new and peculiar form of Mathematics to the expression of the operations of the mind". Also the *Laws of Thought* are "designed, in the first place, to investigate the fundamental laws of those operations of the mind by which reasoning is performed". Since the laws of classes and of their relations are "dependent upon the constitution of the intellect" (Boole 1848), Boole applies his "algebra of 0 and 1" to traditional logic, but with a strong psychological, pedagogical, and even religious motivation and purpose.

Boole, as Leibniz before him, makes a point of the variety of possible interpretations of his calculus of logic. A 'universe of discourse' having been fixed as 1 (and 0 as its complement), schematic letters refer to 'elections' either of individuals (each election producing a class), or to 'cases and conjunctures of circumstances' (each selection picking those cases in which a given proposition is true). In the class interpretation (which enables Boole to reproduce the Aristotelian syllogistic), '$x = 0$' designates that x is the empty class, in the propositional interpretation, that the proposition X is false (and '$X = 1$' that it is true). 'If X, then Y' is rendered as "All the cases of X being true, are cases of Y being true", and expressed as $x(1-y) = 0$.

In *An Investigation of the Laws of Thought*, we have 'primary propositions' (about things) and 'secondary propositions' (about other propositions being true or false), and the conditional 'if X is true, Y is true' is interpreted as saying, "the time in which X is true, is time in which the proposition Y is true". Here Boole, returning to his earlier

expression of 'all X's are Y's' by '$x = vy$' ("the X's are some indefinite part of the Y's"), offers as alternative expression of the conditional the formula '$x = vy$', to be read "the time vy in which Y is true, is an indefinite part of the time x in which X is true". Boole's use of this 'indefinite' symbol has provoked much criticism from contemporary and later authors on symbolic logic, initially above all from William Stanley Jevons (1835–82), Hugh MacColl (1837–1909), Alexander Macfarlane (1851–1913), and John Venn (1834–1923), who were the most important early contributors to the 'algebra of logic'.

Boole's logic was discussed and improved upon in lively debates and 'friendly contests' (MacColl, 1881, "Implicational and equational logic", *The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science* (5), vol. 2, 40–3) among participants who may be said to have constituted a 'logical community' during the time from Boole's *An Investigation of the Laws of Thought* to the work by Ernst Schröder (1841–1902) *Vorlesungen über die Algebra der Logik (Exakte Logik)* (1890). The latter is a kind of '*Summa*' of all earlier methods and results of the classical algebra of logic, particularly of the work of Charles Sanders Peirce and Christine Ladd-Franklin (1847–1930), and highly valued up to now, along with Louis Couturat's *L'algèbre de la logique* (1905, 2nd edition 1914) and C. I. Lewis's *A Survey of Symbolic Logic* (1918, abridged 2nd edition 1960).

Boole's algebraic methods of development and elimination led to modern normal forms and decision procedures, and designers of digital computers use improved Boolean methods for realizing logical functions by minimal chains of operations. Edmund Husserl's criticism of Schröder for favouring extensional logic opened a controversy about a 'logic of content' (*Inhaltslogik*), a controversy which was however ultimately bypassed by another style of doing logic with 'implicational' calculi. It seems that metaphysical and even ontological considerations have played a motivational part in this development, and separated logicians according to their interpretations of logical systems (the most interesting question being that of 'existential import'), but that they have not influenced the development of (Boolean or general) algebra of logic in any significant way.

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CHRISTIAN THIEL

Boscovich, Roger Joseph

Life and Career. Boscovich, the great scientist and philosopher of nature, was born in Ragusa (Dubrovnik) on 18 May 1711. Dubrovnik, now part of Yugoslavia, was at that time an independent mercantile and Catholic republic surrounded by Ottoman territories, and Boscovich's Dalmatian father and Italian mother both came from families engaged in commerce. He was one of a large, energetic, and gifted family, and after attending the Jesuit school in Ragusa, went to Rome to the Collegium, to train as a Jesuit priest.

His life and achievements show him to have had a most remarkably versatile genius. At the age of 24 he began a Latin verse work on eclipses, *De Solis ac Lunae Defectibus*, in 1736 he published work on establishing details of the sun's rotation from just three observations of sun-spots, and in 1737 he provided a reduction of all spherical trigonometry to six fundamental propositions. In 1740, while still a novice, he became professor of mathematics at the Collegium Romanum. In addition to papers on topics of dynamics, astronomy, and instrument design, he was involved in reassuring the

Pope over the stability of the dome of St Peter's, and in a two-year expedition through the Papal States to measure the length of a degree of the meridian, important for testing Sir Isaac Newton's claim as to the oblate shape of the earth. His work in engineering consultancy later extended to Vienna and Milan, and to an important report on draining the Pontine Marshes.

In the period after 1757, Boscovich became more and more involved in diplomatic work, representing either his order or various governments in foreign courts, and he became a traveller throughout Europe, from London to Constantinople, and Poland to Italy. It was during this period that his masterpiece, the *Theoria philosophiae naturalis*, appeared (Vienna 1758, corrected edition Venice 1763). The extended absences from Rome meant that he could not retain his post at the Collegium Romanum, and in 1764 Boscovich took up the chair of mathematics at Pavia. This was combined with work on establishing a new astronomical observatory at Breda, a Jesuit house in Milan, which might have accomplished great things, especially in the exploration of aberration, had not personality clashes frustrated such hopes.

The Jesuit Order's position in Europe became increasingly threatened, and in 1773 the general suppression of the order occurred. This involved the loss of all the Jesuits' institutions and put Boscovich in a very difficult position, from which he was rescued by appointment to the French government post of Director of Naval Optics in Paris. This was an astronomer's role, which he filled with distinction, improving telescopes and navigational manuals, and continuing with theoretical scientific work.

By 1783, now ailing, he returned to Italy, worked on producing a collected works, and died on 13 February 1787.

The Theoria. Boscovich produced over 100 scientific publications, but his renown rests on his theory of the constitution of matter, his doctrine of *puncta* or material points. The physical world consists of unextended, mobile, centres of physical action, without shape, size, or internal complexity. Familiar bodies consist of finite numbers of these points. Every point acts on every other point; each accelerates the other. Whether the reciprocally induced motions tend to increase or decrease the distance between any two points depends only on the distance between them; the action is at some (small) distances repulsive, then attractive, then repulsive again, until at sensible distances a steady attractive influence sets in, very close to Newtonian inverse-square gravitational attraction.

This vision of a world of physical points, related by attractive and repulsive accelerations, had its antecedents, in Leibniz, Vico, Swedenborg, and Michell, and it was taken up, to a greater or lesser degree, in the work of Kant, Priestley, Faraday, and Kelvin. But the fullest, clearest, most thorough and most original version of the theory is Boscovich's.

His first statement of the idea that *puncta*, rather than solid, massy, Newtonian corpuscles, lie at the base of the world of matter, occurs in *De viribus vivis*, written in 1745. But the *Theoria philosophiae naturalis, redacta ad unicam legem virium in natura existentium* is the *locus classicus*. Its title is instructive: Boscovich's theory can be viewed as the ideal form of a pure classical atomism. There is just one single kind of fundamental particle, so all particles are exactly alike. And these *puncta* have only one significant physical characteristic (apart from position and motion), namely their propensity for inducing accelerations in one another. This propensity is the same for all *puncta*. It is a central action, acting always along the line joining the two points involved. It is presented in the famous graph:

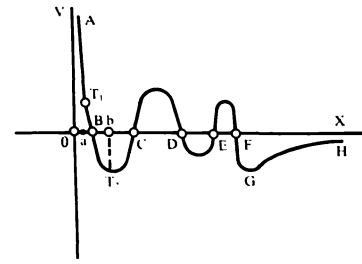

Figure 1

The curve is continuous, and can be represented algebraically as a single function: it expresses a single law and vies for simplicity with any other pattern of positive and negative action.

The title of the *Theoria* calls this law a *force* law. Most commentators now think that the theory is kinematic rather than dynamical: there is no intrinsic mass in these points, and no mechanism is proposed for the exertion of any force. Rather, it is a fundamental, contingent fact that the accelerations induced at finite distances by finite numbers of *puncta* are always finite and always conform to the same single law. The law is better understood directly as a law of accelerations, rather than a law of forces whose consequences are accelerations.

Material points are the simplest possible fundamental items. Without inner complexity, they can give rise to no problems over the cohesion of their parts or their potential instability. Without volume, they deny the existence of any truly extended matter, and thus they do away with the awkward dichotomy of *full* and *empty* space characteristic of the Democritus–Newton corpuscular tradition.

The repulsive arm of the curve, at very small separations, is asymptotic to the ordinate. The mutual repulsion of two points increases without limit upon indefinitely close approach. So two points can never coincide. Real contact never occurs. This solves the notorious problem, for collisions among infinitely hard corpuscles, of infinite acceleration (or equivalently, the possession of many different velocities simultaneously) as two colliding particles share their momenta.

Boscovich's theory is sheerly *qualitative*: he did not claim to know how often the curve winds about the abscissa, nor how large or violent are the reversals from attraction to repulsion. The theory does furnish a lucid research programme, however, and Boscovich emphasized the importance of the *zero points* where the curve crosses the axis, and there is no mutual acceleration. Where increasing the separation at a zero point would involve an increasing attraction, and closer approach would produce repulsion, two points will be in stable equilibrium. Such zero points are *points of cohesion*, and groups of *puncta* at such distances apart can form very stable structures. So Boscovich was able to propose the existence of a hierarchy of molecular 'particles', primary ones being stable groups of points, secondaries stable groups of primary particles, etc. This conception is present in Newton's work, and Boscovich saw himself as carrying Newtonian science forward. But Boscovich's scheme has a clear and intelligible way to explain the formation of complex particles, and resources to account for the cohesion, the instability, and the many different reactions which physical and chemical experimentation reveal. The hierarchy of complex particles makes it possible for uniform *puncta* to display the selective affinity of chemical reactions and such polar phenomena as electricity and magnetism.

Speculative Possibilities. Boscovich's theory is not only fertile and flexible in handling familiar material phenomena, but it lends itself to wide-ranging speculation. For example, if the curve of accelerations were, at some large separation, to become indefinitely largely attractive, this would set a maximum volume to the physical world we inhabit, while providing for further, isolated, worlds beyond: we could never contact them, nor they us. We may live in just one of many 'nested' worlds.

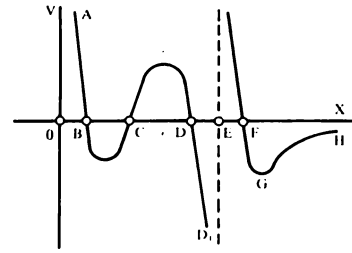

Figure 2

Again, if we suppose two (or more) sorts of *puncta*, with each sort completely indifferent to every other sort, then worlds made from different sorts could 'float through' one another, or share the same space, yet have no effect upon, and hence no knowledge of, one

another. Since the points have no volume, there is room for any number of such superimposed possible worlds.

Modern Developments. The idea of simple, structureless fundamental items, which can approach one another indefinitely closely, has remained a powerful force in theoretical physics. Electrons, neutrinos, and quarks bear witness to this. And Boscovich's insistence on the measurement relativity of space, time, and motion is also thoroughly in keeping with modern physical thought. But in other respects his theory has not withstood the test of ongoing investigation. We are as far as ever from any theory of a *single* type of fundamental item. Electromagnetic interactions are *not* central, and depend not only on mutual *distance* but also on mutual *velocity*. Our modern particles are neither stable nor permanent. Boscovich's theory has no place for fields. And quantum theory is at odds with the Principle of Continuity which informs all his thought.

Nevertheless, it is to Boscovich above all that we owe our possession of one of the great permanent options in the philosophy of nature: mutual action among point particles.

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KEITH CAMPBELL

Bradley, F. H.

Francis Herbert Bradley was born in London in 1846 and died in 1924. He was awarded a fellowship at Merton College, Oxford, in 1870. There were no teaching duties attached to this fellowship and it was terminable only on marriage. Bradley never married and so remained at Merton for the rest of his life. He was a dominant figure within British philosophy in the late 19th and early 20th centuries. His influence was achieved almost solely through three books and a multitude of papers in academic journals. This influence declined as that of Bertrand Russell, G. E. Moore, and Ludwig Wittgenstein increased. Russell's technical grasp of mathematics, symbolic logic, and physics – together with the force of his personality – enabled him increasingly to determine what were to become the central philosophical problems for academic philosophers both in Britain and in the United States. However, it is difficult to see that Russell, or any of the younger philosophers, in any conclusive way, showed Bradley's central arguments to be mistaken. It was rather that they succeeded in changing the framework within which the staple diet of philosophers' problems came to be framed.

Bradley's three books were *Ethical Studies* (1876), *Principles of Logic* (1883), and *Appearance and Reality* (1893). His academic papers were published as *Essays on Truth and Reality* (1914) and in two volumes of *Collected Essays* (1935). The latter contain a high proportion of papers on topics on the borderline between psychology and philosophy. A small book, *Aphorisms*, was published in 1930.

Bradley's thought no doubt has Kantian and Hegelian ancestry but it finally issues in a philosophy which is thoroughly British in its unsystematic mode of presentation, its sceptical tenor, and its respect for sense experience as opposed to thought.

Bradley's scepticism is profound in the sense that it relates equally to our knowledge of our own mental states and to our knowledge of external objects. It is a scepticism in regard to the metaphysical adequacy of knowledge obtained by what Bradley calls 'relational' thought, i.e. thought that is linguistically communicable.

My Real World and the Multiplicity of Worlds. In Bradley's view there is a sense in which it is impossible for me to be sceptical in regard to the existence of the objects of my sense-perceptions at any given moment. This is so since it is essential to my idea of something that exists in the real world of fact that

it exists in the spatio-temporal series that contains my present perceptions and their indexically demonstrable objects, i.e. my body and the objects I can here and now point to and touch. Correspondingly it is essential to my idea of a dream object, or something that is illusory or merely imaginary, that it does *not* exist in the real world of fact.

The system of existence which I think of as the real world of fact will be thought of as containing all human beings' acts of thought and sense-perceptions, and all the 'macroscopic' objects of their veridical perceptions – e.g. the tables, chairs, buildings, trees, mountains, and so on which play a fundamental role in their practical lives. But it will not contain, for instance, the objects falsely believed to exist by human beings in their non-veridical perceptions or in their mistaken empirical or historical conjectures. Nor will it contain, in any straightforward sense, the imaginary worlds of human beings' fictional creations, or logical objects like numbers or propositions, or moral values or God or the ultimate particles of contemporary physics, and so on. However, all such worlds or thinkable systems of objects will, in various ways, play important roles in human beings' lives. In his metaphysics Bradley rejects the view that the reality of such 'unreal' worlds or systems of objects can be intelligibly reduced to the datable psychological acts in which human beings in fact think of them.

In Bradley's view, therefore, there will be an indefinite multiplicity of more or less conflicting worlds or systems of objects thinkable and knowable by human beings in their datable psychological acts of judgement and thought-impregnated perception. Within the context of such acts more or less complex 'ideal contents', or 'ideal constructions', will be *predicated of*, or *referred to*, reality by the person from his point of contact with it in immediate experience. The more comprehensive and coherent such an ideal construction, the more satisfying will it be to the intellect and the more truth and knowledge will it contain.

Bradley's Critique of Relational Thought. However, Bradley argues in his metaphysics that no system of objects known in terms of an ideal construction, no matter how comprehensive and coherent the construction might be, could ever constitute anything more than a more or less inadequate *appearance* of reality. No specific system of objects could ever be reality *as it is in itself*.

The arguments of the first book of *Appearance and Reality*, particularly in Chapters II and III, play a crucial role in this conclusion. The upshot of those arguments is (a) that the purely formal concepts corresponding to the grammatical categories of substantive and adjective (i.e. the concepts *thing*, *quality*, and *relation*) are necessarily exercised in all our linguistically communicable acts of judgement and thought-impregnated sense-perception, and (b) that these formal concepts are inherently self-contradictory.

From these premisses Bradley concludes that all relational thought must eventually lead to self-contradiction. Therefore, no system of objects of a human being's thoughts, or thought-impregnated perceptions, could conceivably constitute reality as it ultimately is. This conclusion rests on the premiss that the principle of non-contradiction provides us with a negative criterion of truth.

We can take the principle of non-contradiction to assert that for any possible subject of predication, R, R cannot be unconditionally both a and *not-a*. We cannot, Bradley argues, deny, or even doubt, this principle without presupposing it. Hence we can know that reality as it ultimately is cannot contradict itself in the way that the particular objects and systems of objects of our relational thinking and thought-impregnated perceptions inevitably do.

Bradley then shows in detail how contradictions in fact arise when the formal concepts in question are exercised in our thinking with respect to space and time, movement, causation, activity, and the self. He thus shows how these specific objects of our knowledge, and any systems involving them, can at best be taken to be more or less inadequate appearances of reality.

The Constructive Arguments in Bradley's Metaphysics. Bradley does not rest with this merely sceptical conclusion. In Book II of *Appearance and Reality* (Chapter XIII) he argues that we can, after all, draw some

positive, albeit formal, conclusions as to the ultimate nature of reality. The premiss for this part of Bradley's argument is the thesis that any true negative judgement must rest for its truth on a positive character which is possessed by the logical subject of the judgement. Hence, Bradley argues, since we know that reality (the ultimate logical subject of any possible predication we make) cannot contradict itself, we can infer that reality must in its ultimate nature be a *consistent* system of existence. But, as Bradley acknowledges, 'consistent' in this context cannot mean what it ordinarily means, namely the relational property that any two propositions possess when they are capable of being true together. It cannot be taken to mean this, since reality cannot be a mere system of propositions, nor *ex hypothesi* is it adequately representable by any such system, no matter how comprehensive and consistent. Consistency in this context must be construed simply as that character which excludes the possibility of reality being adequately represented in relational thought. Bradley normally uses the term 'harmoniousness' to designate this character. We can know, therefore, that reality must be a harmonious system of existence.

Further, we can know, as a corollary of the arguments of Book I of *Appearance and Reality*, that reality cannot be a plurality of independent individual substances. We can know this since we can know that any system of objects describable in a language involving 'the machinery of terms and relations' (as any pluralistic system must be) can only constitute a more or less inadequate appearance of reality. Hence, we can conclude that reality must, in some sense of the term, be a *single* utterly comprehensive system of existence.

Reality as Immediate Experience. Bradley then asks if we can give any material content to this merely formal schema. Reality cannot be known as it ultimately is by means of our relational thinking and thought-impregnated perceptions. But we can, in Bradley's view, frame the idea of a mode of experience by means of which reality could be known perfectly and which would thus satisfy the demand intrinsic to our relational thinking. It would have to be an *immediate*, or non-thought-impregnated, experience. In that respect it would have to be analogous to the immediate experience against the background of which, in our acts of judgement, we predicate of reality our various ideal constructions. In such an experience there is no distinction between subject and object: it is, therefore, in a sense, 'blind'. But nevertheless there is *something that it is like* to have it. Its content is known by acquaintance in having it and it is thus a knowing-and-being-in-one.

Hence we can conclude that the ultimate subject of our predications could be known perfectly or with complete adequacy only in an *immediate* experience. In other words, reality could be known as it is in itself only by means of an experience in which there was no distinction (as there necessarily is in our thought-impregnated experiences) between the experience and the experienced. Therefore we can conclude that if it is to be knowable as it is in itself, reality itself must *be* an immediate experience. It must, of course, be an immediate experience of an altogether higher kind than that enjoyed, or suffered, by finite centres of experience. And we can know, given that we have already established the formal features that reality must have, that the identities of the totality of apparently different finite centres of experience must somehow be embraced in the *single* utterly comprehensive, and therefore self-subsistent, experience constitutive of reality as it is in itself.

Of necessity we cannot frame any idea of what such a totally harmonious immediate experience would be like. Moreover, the increasingly satisfying experience that we can in fact enjoy in our thinking (as we succeed in making our various ideal constructions increasingly comprehensive and coherent) could never, without losing its relational nature, be identical with that utterly comprehensive and harmonious experience which is what Bradley calls the Absolute.

The Solution of the Dilemma of the Relation Between Thought and Reality. Bradley concludes that if we accept his account of the Absolute (as a single self-subsistent supra-relational experience somehow embracing a totality of finite centres of experience and

appearing more or less inadequately in their thinking and thought-impregnated experiences) we can solve a dilemma that renders self-contradictory all other attempts to give an account of the nature of the relation between our thought and reality. The dilemma stems from the fact that we are constrained to assert that reality must be different from our thought. We must do this since we must take our relational thought, in so far as it is true, to be true in virtue of how reality is quite independently of our thinking about it. But then, it seems, we cannot give an intelligible account of the difference between thought and reality, since in order to do so we would need, so to speak, to stand outside both thought and reality and think truly about them.

Bradley argues that his account of the Absolute successfully portrays reality in its ultimate character as something quite different from mere relational thinking but at the same time it does not portray it as an utterly transcendent and unknowable thing-in-itself. The ultimate subject of our predications (reality) is portrayed as essentially other than relational thought but yet as (a) something we can infer the character of simply by reflection on the demand for comprehensiveness and coherence intrinsic to our thinking and (b) something in the experience of which the demand intrinsic to our relational thought would be satisfied perfectly.

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GUY STOCK

Brentano, Franz

Franz Brentano was born at Marienberg, near Boppard/Rhein, on 16 January 1838 into a distinguished German family of Italian origin and brought up in a Roman Catholic background. He studied both philosophy and theology, *inter alia* with Adolf Trendelenburg, to whom he dedicated his doctoral dissertation *Von der mannigfachen Bedeutung des Seienden nach Aristoteles*. He received his Ph.D. in 1862, was ordained a priest in 1864, and in 1866 he received his habilitation in Würzburg where he was *Privatdozent* and professor of philosophy until 1873. In that year he resigned from his chair as a result of the tremendous pressures he had had to face ever since his paper of 1869 on papal infallibility, in which he had argued that the doctrine was unnecessary, dogmatically wrong, and lacking in historical support.

After the proclamation of the dogma of infallibility, Brentano had less and less in common with Catholicism, because he could not tolerate feeling himself obliged to assent to non-evident and indeed wrong principles. Carl Stumpf and Anton Marty, famous students of his in Würzburg, joined him in this view. From 1874 until 1895 Brentano served in Vienna. In 1879 he left both the priesthood and the Church. In 1880, he took up Saxon citizenship in Leipzig, where he was also married – as a result of which he was once more driven to resign his professorship in Vienna, where he served from 1880 as a mere *Privatdozent*. His most well-known students there were Edmund Husserl, Alexius Meinong, Christian von Ehrenfels, Thomas G. Masaryk, and Sigmund Freud.

After leaving the University of Vienna, Brentano spent his life alternately in Florence (in 1896 he became an Italian citizen), and Schönbühel, Austria. His last two years he spent, still deeply involved in scientific work, in Zürich, where he died on 17 March 1917.

Brentano was inspired especially by the philosophy of Aristotle, whom he regarded as a 'man of all times'. Much of his work is dedicated in a critical spirit to Aristotelian issues, especially concerning psychology and ontology or metaphysics.

Psychology. Already in his habilitation

thesis, *Die Psychologie des Aristoteles* of 1867, Brentano sets forth the programme for his psychological theory of knowledge. Psychology, Brentano holds, has to investigate its 'proper objects': the soul and its parts or faculties, especially the intellectual faculties. This, he thought, will provide the foundation for an entire philosophy, so that Brentano was predictably accused of psychologism. The investigation of the intellectual part of psychology, he tells us, "leaving totally aside the more physiological part", will in fact provide the principles for all other sciences. Or, as he puts it in his still unpublished *Lectures on Metaphysics* of 1867 onwards, all other sciences get their 'preamble' and 'precondition' from psychology which, in turn, is their 'foundational integral part'.

Brentano seeks not a complete 'compendium of psychology', however. Rather his intention is to provide a scientific and rigorous foundation for the discipline in a way that will replace the multiplicity of theorems with a 'unity of conviction' and replace the many psychologies current in his day by 'one psychology' (*Psychology from an Empirical Standpoint* I, 1874; hereafter *Psychology* I, cited after the 1924/1973 edition). Here, as elsewhere, his goal is to deduce the multiplicity of facts from a single unity.

Descriptive Psychology or Ontology of Mind. First, however, an empirical Brentanian psychologist has the task of designating or describing the first or primary elements of human consciousness from out of which conscious phenomena in general are built up. Description, here, relates not to genetic or psychophysical preconditions but rather exclusively to what the psychologist can gather from his own experiences. His inner awareness has to grasp a cross-section of facts of human consciousness which will supply the necessary 'empirical material' for his psychological studies. Second, he has to 'notice' or 'explicitly perceive' these experiences. Third, he has to hold fast (*fixieren*) what he has noticed, and to compare what is noticed with his own and others' knowledge. Fourth, he has to generalize the psychic experiences inductively in order to arrive at general terms, and in order inductively to grasp general psychic laws expressed by means of these terms. Fifth, he has to 'apply deductively' the general laws thus found, in order "to solve some otherwise unsolvable questions with regard to the elements" (*Deskriptive Psychologie*, Hamburg, 1982).

The method of descriptive psychology, or 'descriptive phenomenology', as Brentano also calls it, is that of analysis of the psychic elements, or of psychic phenomena in general, an analysis which will reveal how the parts are linked with one another in such a way that they function together to form a whole. Brentano emphasizes hereby that descriptive psychology and indeed philosophy have to utilize a method analogous to that of the natural sciences. What Brentano calls his "anatomy of the soul" is analogous to procedures both of its 'sister science' of physics and of metaphysics.

Intentional Inexistence. Brentano held, with Aristotle (*De An.* 415a16), that the more psychology has developed, the more it has found that the most fundamental differences are to be searched for *in the relation of the mind to its object*, in the different modes of our relation to the "immanent object of psychic activity" or the different modes of "intentional inexistence" of the object (*Psychology* II, (1971), pp. 32–33 and 100; *Deskriptive Psychologie*, pp. 147–5. *Die Psychologie des Aristoteles*, pp. 75, 82).

By intentional inexistence Brentano means to refer to an 'immanent objectivity', an 'inner object' (*etwas innerlich Gegenständliches*) or, in medieval terminology, an *esse objective*. Sometimes he talks more simply in terms of "subjective behaviour [*subjektisches Verhalten*] of the soul", pointing out that:

> No one can properly doubt whether the psychic state which he perceives in himself exists, and whether it exists in such a way as he perceives it in himself (*Psychology* I, p. 14).

Thus there is a certain Cartesian evidence pertaining to the psychic act with its two correlate moments of thinking and what is thought of. In his *Deskriptive Psychologie* Brentano deals almost exclusively with the act side of this relation in order to establish a 'pure', 'exact' mental science of the Cartesian

psychological properties of thinkings in general and of presentations, judgings, lovings, hatings, and so on, in particular.

The Classification of Psychic Phenomena. In contrast to the traditional tripartite division of psychical phenomena into thinking, feeling, and willing, Brentano proposed a classification of the psychical into:

1. presentations (*Vorstellungen*),
2. judgements, and
3. emotions ("phenomena of love and hate", or "interest phenomena").

Presentations are, for example, the having of a concept, the experiencing of a red sense-datum. As in Kazimierz Twardowski and Carl Stumpf, they are the 'fundamental functions' of the mind. Acts of judging and emotional phenomena are 'superposed' upon them. A presentation is a ('one-sidedly separable') 'support' on the ground of which alone we can judge or have emotions. The acts of judgement and emotion thus superposed are new, additional, 'idiogenetic', categorially different states of mind, not (as in David Hume) mere aggregates of presentations, yet they are inseparable from ('one-sidedly dependent' on) their bases. Judgings and emotions differ in that they are categorially different attitudes, though they are analogous in sharing a bipolarity between a pro-attitude (affirmation and love, respectively) and an anti-attitude (negation and hate, respectively). Presentations lack this bipolarity.

Metaphysics, or the Ontology of Things. Brentano interprets the person or the 'self' as the bearer (the thinking substance) of its psychic acts or states (the accidents). He affirms a two-fold relation ('double energy') of every psychic state: on the one hand, the thinker is directed to some object (his 'primary object'); at the same time, however, the thinker is directed also (*en parergo*, as Aristotle had said) to himself as 'secondary object'. This reflexive ego is both the subject and the object of psychology. In his *Lectures on Metaphysics*, and in his *Theory of Categories (Kategorienlehre*, Hamburg, 1974), Brentano develops on the basis of his psychology what might be called an ontology of things (substances and accidents). Where, in his psychology, he had 'set aside' the objects of 'outer experience', in the context of his metaphysics he argues for the value and validity of our mediate, indirect knowledge of bodily substances and their properties. Among such substances he includes such items as places, rooms, the sizes of things, and their temporal and local determinations. Brentano distinguishes a 'narrower' ontology ('special metaphysics') from a broader ontology ('general metaphysics'). The latter deals:

1. with issues of theology (God), and cosmology (world), with properties of all beings, including universals, propositions, possibles, impossibles, noemata, inexistence, past and future things (Brentano was later to reject non-real beings);
2. with the parts of such entities;
3. with the causes of such entities.

Special metaphysics is the basic part of general metaphysics. It is concerned with the definition of the meaning of proper being (*eigentlich Seiendes*), of the nature, essence, substance, and principles of the things (*res*). In his early dissertations and lectures on ontology and metaphysics, Brentano already sets out this emphasis on *realia* (cf. his later *Turning Away from the Non-Real, [Die Abkehr vom Nichtrealen]*, Hamburg, 1966), or, as Tadeusz Kotarbiński later puts it, on 'reism' or 'concretism'. The aim of special metaphysics, then, is to investigate *Sachhaltigkeit* (thingliness), not what is immanent in our mind (about which the psychologist and the logician speak). One of the most important concepts here is that of things and their physical, logical, and metaphysical parts.

Physical parts are, for example, the tail of a sparrow, the fingers of a hand, real parts of a real continuum, boundaries of bodies, and such unequal parts as, e.g., mind and body, which Brentano sees as forming a (temporary) whole. Brentano here proposes a solution to the mind–body problem which is *expressis verbis* against the solutions of both Aristotle and Leibniz and also against atomism.

Logical parts are, as for Aristotle, the 'parts of a definition'; e.g. "colour [is] a logical part of redness, being a Gestalt is a logical part of being a spherical Gestalt", and so on. They are called 'logical' parts because a logical expression of a thing, i.e. its definition, consists of them in the strong sense. The logical whole is an individual of a certain genus. The logical part is every part of its definition, thus genus, difference, further difference (difference of difference) etc., down to the lowest universality (*species specialissima*). Every logical part is merely conceptually or 'distinctionally', not really, a part of the logical whole of which it is a part. Thus there is a sense in which universals do not really exist in separation from individuals of the corresponding sorts. Brentano here presents the traditional problem of universals as a problem of logical parts.

Under the heading *metaphysical parts*, Brentano discusses the relation of substances and accidents, of places, of time, and of thinking. Each different sort of metaphysical part belongs to its corresponding whole in a different way – designates, predicates, or categorizes it from another side. The different categories arise according to the way in which an accidental whole (e.g. a judging person, this red place) includes its substantial part (a thinking person, the place itself). The *substantial part* is the subject or substratum for one or more *accidental wholes* (such and such a thinking, such and such places). The substantial part is an independent, one-sidedly separable thing in its own right, a bearer of accidents, and as such it individuates accidents from one another. As Brentano puts it in the *Theory of Categories*: "Any knowledge is an accident, and any thing that has knowledge, is a substance". Elsewhere in this work, Brentano shows how to make use of the descriptive psychological theory of mental phenomena in the construction of an ontology or metaphysics as a descriptive empirical and therefore 'non-*a priori*' science.

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WILHELM BAUMGARTNER

Brouwer, L. E. J. See: Intuitionism

Bruno, Giordano

Giordano Bruno (1548–1600), a Dominican in Naples, led an unsteady vagrant life, relocating in France, England, and Germany following the severence of relations with his order in 1576. In 1592 he was arrested by the Inquisition in Venice and was charged with heresy. Eight years later he was burnt publicly in Rome in the Campo dei Fiori. His works written in Latin and Italian deal with themes of cosmology, metaphysics, mnemonics, and moral philosophy. Together with Descartes Bruno is one of the fathers of modern thought. But unlike Descartes, who started his philosophy from the *cogito*, Bruno saw concrete subjectivity or feeling as the real correlative of the world. In this respect Bruno completed the Renaissance discovery of man and world.

Rated by their historical influence, Bruno's cosmological writings (*La cena de le ceneri*, *De l'infinito universo e mondi*), in which he accepts the Copernican system, are his most important. Copernicanism means to Bruno both liberation from the closed world of the Aristotelian hierarchical cosmos and a struggle against theological dogmatism. Unlike Galileo, therefore, Bruno is not to be seen as a founder of modern mathematical-scientific rationality. He maintains a certain reserve as regards mathematical thought. The Copernican system serves Bruno only as a pillar of cosmological speculation on infinity, speculation of a sort that is based on metaphysical principles.

Bruno's metaphysics, as developed in the dialogue *De la causa, principio et uno*, connects the Aristotelian matter-form dualism to Platonic and Neoplatonic elements. He adopts an ontological position which dissolves the dualism of matter and spirit and makes of matter a dynamic principle. Bruno's conception of matter has a theological basis. He doubts the personalistic notion of God, and especially the doctrine of incarnation. The German idealists therefore have considered Bruno, along with Spinoza, as a follower of pantheism. And yet, despite his depersonification of God, Bruno maintains a difference between God and the world. To the world is attributed a reality which goes beyond what is allowed by the Christian idea of the creation.

However, the terms 'universe', 'matter', and 'God' do not cover Bruno's thought in its entirety. His focal point is anthropology. Indeed, the individual as an acting and suffering entity constitutes for him the standard of all philosophical concepts. Man, sharing in the abundance of the world, acquires a new self-consciousness. The self-consciousness of man facing the world is discussed by Bruno in his dialogue *De gli eroici furori*. Here man is seen as being a part of the world and at the same time as standing outside it. However, the dialectic of participation and alienation does not lead to nihilism in Bruno's view, but to a concept of mind which has been interpreted as hermetic, but which can better be referred to as a form of 'intensive thinking'. The transformation of metaphysics into a new concept of subjectivity hereby reaches its completion.

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FERDINAND FELLMANN

Bühler, Karl

Karl Bühler was born in Meckesheim, Germany, on 27 May 1879. His parents were farmers. He entered the medical school of the University of Freiburg, where he received his M.D. in 1903. He then wrote a doctoral thesis in physiology under Johannes von Kries (1853–1928), with the title *The Duplicity Theory of Colour Vision*. He had also begun philosophical studies at the University of Strasburg, where he earned a Ph.D. in 1904 with a thesis entitled *The Psychology of Henry Home* (Lord Kames). After that, he worked as an assistant of Kries and carried on his psychological studies in Berlin under Benno Erdmann (1851–1921) and Carl Stumpf (1848–1936). In 1906, he became assistant to Oswald Külpe (1862–1915) in Würzburg and, in 1907, he submitted his habilitation thesis, *On a Psychology of the Courses of Thinking*.

In 1909, Bühler followed Külpe to Bonn, and in 1913 on to Munich, where he was made extraordinary professor. After a period in Dresden, he became, in 1922, professor of psychology and head of the Psychological Institute at the University of Vienna. In 1938, he was imprisoned for philo-Semitic behaviour (his wife, Charlotte Bühler, was Jewish), but was able to make his way to the United States and ultimately to California, where he died in 1963.

Psychology, for Bühler, is a science which straddles two domains: on the one hand, it is a part of the natural life sciences, along with biology and medicine; like them, it deals with animals and men. On the other hand, it is one of the humanities or *Geisteswissenschaften* in that it investigates the attributes and modes of being human. This view Bühler defended in the influential book of 1927, *Die Krise der Psychologie*, in which he rejected the monism of methods that he saw in behaviourism, *Erlebnispsychologie* and psychoanalysis.

Bühler's lifelong interest was in the steering or controlling of mental processes. He conceived of the mind as embedded in a biological matrix but as constantly transcending it. He started out as an outstanding member of the Würzburg School, where he investigated the thinking processes via a

question-and-answer method. He was led to postulate certain ultimate elements of the thought process which he called *Gedanken* or thoughts, elements which are held to show no sensory quality or intensity and to be *imageless*. In order to describe the genesis of higher mental phenomena, Bühler observed children and, together with his wife Charlotte Bühler, published two books on intellectual development. These saw the process of humanization or *Menschwerdung* as being divided into three stages: the first stage is characterized by the dominance of *instinct*; the second by *training* or trial-and-error ('dressage'); and the third is that of *intelligence*, which is distinguished by the skilled use of intellectual and physical tools. Correspondingly, Bühler distinguished three motivational systems: first is what he called pleasure through the satisfaction of need; second is pleasure in activity or in functioning (*Funktionslust*); third is pleasure in creative work or *Schaffenslust*.

In his Vienna years, Bühler developed especially his theory of language and linguistics. He concentrated on the function of the language-using individual as a control system (*Steuerung*), whose effects he described in his so-called 'organon model'. Speech signs are seen as varying with respect to the speaker, the hearer, and the objects and states of affairs to which they refer. The three basic functions of language are then:

1. the expressive function (*Ausdruck*),
2. the appeal function (*Appell*), and
3. the representative function (*Darstellung*).

Bühler was influenced also by the Gestalt psychologists and introduced Gestalt principles into the study of language by conceiving the relation of the speech sign to its environment as a type of figure–ground relation.

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ELISABETH BAUMGARTNER

Buridan. See: **John Buridan**

Burley. See: **Walter Burley**

C

Cajetan

Cardinal Thomas de Vio, better known as Cajetan, was born in 1469 at Gaeta. He became a Dominican friar and is generally reckoned the greatest of the Renaissance commentators on Aquinas's writings. His literary career from 1494 to 1499 was primarily philosophical, yielding the commentary on Aquinas's *De ente et essentia* and the original work *On the Analogy of Names*. From 1499 to 1523 he mainly produced theological works, such as the commentaries on the *Summa Theologiae* of Aquinas (1507–22), while after 1523 until his death in 1534 he was occupied chiefly with biblical exegesis in which, as sticking to the original texts and insisting first upon the literal sense, he was something of a pioneer.

The two elements of Cajetan's work most discussed in our own times are his treatment of analogy and, more recently, a supposed neglect of the 'existential' element (*actus essendi*) in Aquinas's metaphysics. Those who maintain the latter often fault him on analogy as well, as having presented a purely logical rather than a metaphysical doctrine thereof.

But despite these criticisms (Gilson 1953), it would appear on closer analysis (Reilly

1967) that Cajetan's theory of metaphysical analogy as restricted to the four-term analogy of 'proper (i.e. non-metaphorical) proportionality' (*A* is to *B* as *C* is to *D*) directly depends upon his Thomistic conviction that *esse*, the act of being, is really distinct from essence. Gilson (1953) seems to have been misled by Cajetan's adoption of Scotist terminology (*esse actualis existentiae* for *esse*, *esse quidditativum* said of the essence) – terminology which he, Gilson, regarded as 'formally essentialistic' – into suspecting Cajetan of Scotism. A more inclusive examination of Cajetan's texts would show that the resemblance lay only in terminology, that of a later age, the thought being Thomist throughout (Elders 1985, p. 149f.).

In fact Cajetan, under pressure from his Scotist contemporary, Antonius Trombetta, concerning his use of *esse actualis existentiae*, refuses to reduce the act of being of a substance to its extrinsic relation to its efficient cause (*esse actualis existentiae* in the Scotist sense of a merely factual existence) but holds fast to the Thomistic sense of it, i.e. of *esse*, as "the most perfect . . . the actuality of all things, and even of forms" (Aquinas, *Sum. Theol.*, I, 4, 1 ad 3) as his commentary makes plain. For besides three arguments for the real distinction between essence and the act of existing (*esse*) he goes on to answer ten objections posed by Trombetta (in an unpublished work) in a way that makes it plain that he is not just speaking of existence in general (but cf. Gilson 1953, note 1) but of the unique act of being of each and every conceivable thing. Thus he makes plain that existence is not a further, spurious essence, but constitutes a different order altogether, to which all essence is purely potential. But he adds to this, in clarification, that essence and *esse* are not related as act and potency in the order of essence (the Scotist misreading of Aquinas), but in the order of existence: "act in the order of existence plus act in the order of essence do not give substance", for Cajetan, "but existing substance".

Here he adds that he finds no explicit trace of this doctrine in Aristotle, a remark indicating that he was not, as has been said, more purely Aristotelian than Aquinas, since he has just finished defending this specifically Thomist doctrine.

In assessing Cajetan's doctrine of analogy one finds varying opinions among modern Scholastics (and others). For Cajetan the only metaphysical and hence *proper* type of analogy is that "according to (both) being and intention" (Aquinas, *In I Sent.* 19, 5, 2 ad 1), the example given being precisely being (*esse*, act of being) itself. "Despite the fact that their quiddities (i.e. of substance, quality, quantity, etc.) are not only diverse but even primarily diverse, they do retain a similitude in this that each of them has a 'to be' proportioned to itself." This is called by Cajetan the analogy of proper proportionality (not to be confused with the improper or 'extrinsic' analogy of attribution or proportion). Whereas proportion here means any relation of one thing to another, proportionality "is given to a similitude of two proportions", i.e. not to an equality (as in arithmetic, from which the idea is taken). Hence this analogy is not reducible to univocity but is found in reality itself. For in the metaphysical or real order (as opposed to the order of essences) there is, it is claimed, no likeness of things to one another but only of proportions (of each thing to its own act of being). Hence the likeness in question is itself analogical, not univocal, and being is irreducibly an analogical concept, not able to be perfectly abstracted from what has it.

This is why the basis of all 'proper' analogy is this analogy of the act of being, unique to each individual thing and because of which that thing is itself and not another. So this identity in nature of two acts of being is itself proportional, and Cajetan takes pains to show that proportional identity is a real species of identity and the only possible one through which one can argue in metaphysics in such a way as to avoid the fallacy of four terms. In support he cites Aristotle: "connexions requiring proof which are identical by analogy have middles also analogous" (*Post. An.* 99a, 16). Hence he can speak of scientific knowledge "of the analogous" as possible "if due attention is given to proportionality".

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STEPHEN THERON

Calculus

The calculus has its principal origins in the determination of the slope of a tangent to a curve and the area enclosed under that curve relative to fixed axes. Some Greek mathematicians, especially Archimedes, devised procedures for both types of problem; activity increased especially during the 17th century when the analytical geometry of René Descartes provided new algebraic techniques to express and extend these procedures.

The calculus developed into its 'fully fledged' form when the problems of determining the slope and the area were understood to specify *new functions* from the given function, and the processes of finding them were recognized as inverse. These insights were achieved in the late 17th century by Newton and Leibniz, independently and in different forms.

The Leibnizian 'differential' calculus was based on the notion of the differential dx as an infinitesimal increment on x, and of the same dimension as x; the slope of the tangent to a curve with y as a function of x was the ratio dy/dx. The integral, $\int x$, was infinitely large and of the dimension of x; thus for linear variables x and y the area $\int y\,dx$ was the sum of the areas of rectangles y high and dx wide. All these quantities were variable, and so could admit higher-order differentials and integrals (ddx, $\int\int x$, and so on). The standard form of this theory was established during the 18th century, especially by Leonhard Euler (1707–83); it was extended to functions of several independent variables, and to the creation of the calculus of variations.

By contrast, the less successful 'fluxional' tradition initiated by Newton used limits (in a naïve way) in its basic definitions and thereby involved *changes* in dimension (a point as the limit of a sequence of lines of decreasing length, and so on). The fluxion was the rate of change of a variable quantity relative to time (understood conventionally); conversely, that variable was the 'fluent' of its fluxion. Once again, these quantities were variable, and so fluxions and fluents of higher orders could be defined from them.

In addition, by the late 18th century some currency was granted to the view of Joseph Louis Lagrange (1736–1813) that the calculus was definable by purely algebraic means from the Taylorian power-series expansion of a function y about any value of x. By these means it was hoped to avoid the use of both infinitesimals and limits.

In the early 19th century all these views became somewhat eclipsed by the 'mathematical analysis' of Augustin-Louis Cauchy (1789–1857), a theory which incorporated also the theory of functions and the convergence of infinite series. Like Newton's calculus, it was based upon the theory of limits, but they were handled in a far more careful way. A major feature was the specification of necessary and/or sufficient conditions under which theorems were held to be true. In particular, Cauchy replaced the usual practice of defining the integral as *automatically* the inverse of the differential (or fluxion or whatever) by giving *independent* definitions of the derivative and the integral; thus for the first time the fundamental 'theorem' of the calculus, concerning their inverse relationship, became a genuine theorem, requiring sufficient conditions upon the function to ensure its truth.

The next main strides were taken in the second half of the 19th century under the inspiration of the teaching of Karl Weierstrass (1815–97) at Berlin. Two aspects need emphasis here. First, the refinement of fundamental theorems, and also technical questions largely concerned with trigonometric series, led to the emergence of set topology, and after that general set theory with its later links to mathematical logic. Second, special attention was given to processes involving several variables changing in

value together, and as a result the importance was recognized of reversing the orders of quantifiers (to use the modern expression) – for example, from 'for all x, there is a y . . .' to 'there is a y such that for all x . . .'. Georg Cantor was a major figure in the first aspect, Giuseppe Peano (1858–1932) in the second.

Infinitesimals became unacceptable, especially in the tradition established by Weierstrass; but in our own times some theories have been advanced in which his level of rigour and generality are preserved (and even extended) but in which infinitesimals have been reinstated. The best known of these theories, the 'non-standard analysis' of Abraham Robinson, makes use of model theory by defining infinitesimals as arithmetical inverses of the infinitely large integers generated by a 'non-standard model' of Peano's axiom system for the natural numbers. Other developments of the calculus in this century have hinged largely on generalizations of some kind of the Weierstrassian theory, without raising new philosophical questions about the subject.

The status of infinitesimals is a principal metaphysical question in the philosophy of the calculus; a variety of different forms has been used over time. Another closely related philosophical issue is the search for foundations for the theory of limits; and a miscellany of questions concerning infinite series, functions and set theory (and thereby logic), and the applications of the calculus to the physical world, continue to interest mathematicians, historians, and philosophers. A long tradition is thereby continued; for the calculi of the Greeks and of the 17th century were related to philosophical questions such as the nature of continuity and the analysis of change.

The literature is too vast to receive any summary here; the works listed have large bibliographies.

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IVOR GRATTAN-GUINNESS

Calovius, Abraham

Abraham Calovius (Calov) was born on 14 April 1612, in Morungen in East Prussia. He attended school first in Morungen and studied for a short time in Thurn, but had to return home to escape the plague. He is said to have suffered from a speech impediment which he overcame through the encouragement of the example of Demosthenes. He then attended the convictorium at Königsberg, beginning at the tender age of 13 in the year 1626. He remained there for six years and was promoted to *magister* in 1632. In 1634 he moved to Rostock, where he received his doctorate in theology in 1637. By 1640 he was professor of theology at Königsberg and he was appointed rector of the gymnasium in Danzig. Seven years later, in 1650, Calovius took a professorship in theology at Wittenberg, where he remained until his death in 1686.

Calovius is well known for his theological attacks on the syncretic movement in the Lutheran Church at that time, which attempted to reconcile the differences between the various Protestant sects and the Roman Catholic Church. His most interesting metaphysical works are the *Metaphysica divina pars generalis* and the *Metaphysica divina pars specialis*. Calovius's logical/epistemological works, the *Gnostologia* and *Noologia*, may be of some interest, although as logic the works are weakened by the psychologism which is often found in logic texts of that period and school.

Calovius is a good example of the typical Protestant metaphysician of the 17th century. According to Calovius, one's metaphysical studies should be guided by the truths of revealed faith, in this case orthodox Lutheranism. Without the guidance of the celestial light, all our travels into scholarly study are nothing more than pitiable wandering. But we cannot follow this celestial light unless we pay attention to both Scripture *and* nature. Calovius reveals himself to be a true scholastic by naming Aristotle the foremost philosopher. Thus, the main task of Calovius's work is to reconcile the revealed truths of orthodox Lutheranism with the principles of Aristotle's metaphysics. That one is so enabled to re-

fute the errors of agnostic natural scientists, Socinians (a favourite target of Protestant attacks, this Protestant sect denied the doctrine of the Trinity and the divinity of Christ), Jesuits, Calvinists, and other heretics, so much the better. Still, *both* sources of knowledge are required: without Aristotelian natural science, there will be factual errors; without Scripture, heresy. (*Hinc tot errores, tot haereses.*)

Metaphysics, according to Calovius, is the wisdom of being *qua* being (*sapientia Entis qua Entis*). This definition should be understood as denoting one discipline, which is also called 'ontology' or 'transcendental wisdom' (ὀντολογία *sive transcendentalis Sapientia*). The usual and improper sense of 'metaphysics' adopted by the Jesuit Benito Pereira (*c.* 1535–1610), according to whom metaphysics is concerned with disembodied spirit, is rejected. Indeed, he says, they hallucinate who make the object of metaphysics either God or immaterial substance, and they plainly do not understand the nature of wisdom.

Thus, Calovius believes that the mistake of people like Pereira was to fail to acknowledge a notion of being which is general enough to be common both to spiritual and material beings. This, of course, may not be entirely fair to Pereira and other Thomists, since theological discomfiture may arise from claiming that God and creatures are subsumed under a general concept of being. Does this most general of concepts logically or ontologically precede God? Or is the dignity of God affected by sharing the notion of being with beings like you and me?

Metaphysics, finally, must deal with what *really* is, not merely what *could* be. Calovius claims that truly and properly, metaphysics concerns itself with non-complex, essential, positive, real, actual being (*Ens incomplexum, per se, positivum, reale et actuale*). Only in an attenuated sense does it contain complex, accidental, deprived beings, beings of reason, and potential beings (*Entia complexa, per accidens, privationes, Entia rationes et in potentia*). Calovius prefers to limit metaphysics to the former, and we might not incorrectly call him an 'actualist'. After all, Calovius wonders, how does one abstract a notion of being common to actual and potential being, if potential being is not truly being?

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JEFFREY COOMBS

Campanella, Tommaso

Tommaso Campanella (born in Stilo, 1568, and died in Paris, 1639) was one of the most original thinkers of the late 16th and early 17th centuries. He combined the Renaissance philosophy of nature with political and religious themes, placing them all in the framework of Platonic metaphysics. He wrote most of his works in Naples, where he was imprisoned for twenty-seven years for conspiring against the Spanish government.

In the most celebrated of his works, *The City of the Sun* (1602), he outlined the ideal city ruled by rational and natural principles (instead of fortune and irrationality), where men could live harmoniously in society and nature. In addition to this well-known Utopia, Campanella wrote many other political works in which he attempted to restore the connection between ethics and politics which Machiavelli (1469–1527) had broken. In his *Atheismus triumphatus* (1607) he stated that religion was natural, and not, as the doctrine of reason of State claimed, a human fraud invented by rulers.

He also wrote a courageous *Apologia pro Galilaeo* (1616), in which he asserted that Aristotelian physics, and not Copernican theory, conflicted with Catholic theology. Persuaded that the two divine books, that of the Scriptures and that of nature, could not be contradictory, Campanella maintained that Galileo should be allowed to investigate the book of nature freely. Campanella's

astronomical views were also linked to prophecy and astrology, as we can see in his *Articuli prophetales* and *Astrologicorum libri*, whose seventh book, the *De fato siderali vitando*, made public the practices of natural magic he performed with Pope Urban VIII to avoid the threatening influences of an eclipse of the sun.

His conception of nature, derived from Telesio, was thus very different from that of Galileo, who asserted that the book of nature was written in mathematical characters. According to Campanella, the most important aspect of nature was the *'sensus rerum'*. In his *Del senso delle cose e della magia* (1604) he claims that every being is endowed with the degree of sensitivity needed to achieve its self-preservation. In every being, he stated, we can find some sensitive *'spiritus'*, made of a warm, subtle matter, which, when brought into contact with other objects, desires what it feels is good and avoids what it feels is harmful. So nature is seen as a body of attractions and repulsions aimed at maintaining and increasing life. It is a composite whole of ends, perceived by everything with different degrees of consciousness.

These numerous themes come together in his monumental *Metaphysica*, published in Paris in 1638. In this book, which Campanella proudly called "the Bible of the philosophers", he intended to discuss the principles and the ends of things, and the fundamentals of the sciences, so that one could "examine sciences in relation to the book of God and see their internal connections through an encyclopaedia of knowledge".

Campanella begins his inquiry by analysing the objections that had been raised against sensual knowledge – considered uncertain, partial, and inconstant. But, with an explicit reference to Augustine, he affirms that the subject, while and because he is doubting, reaches the first indubitable principle that he exists and is able to know and will. For the subject this original or innate knowledge of himself is the starting-point for knowledge of external objects. The latter affect the subject, who feels himself affected by them. On the one hand knowledge is a process of alienation, because the *'notitia addita'* that comes from outside makes the interior *'notitia indita'* more confused and obscure; on the other hand knowledge also implies the development of the subject, which, assimilating and perceiving the alterations of his own being, learns more and more about himself.

Within this context, Campanella insists on the pre-eminence of sensual knowledge, seen as direct contact with real beings, as opposed to Aristotle's intellectualism, and in general to philosophy based on words and books rather than on things and nature. But the core of the *Metaphysica* is his theory of the *'primalitates'*: 'Power', 'Wisdom', and 'Love', which are in God in infinite degrees, are present in every being as well, in that they are the primary elements which constitute being itself. Single beings are limited, various and distinct because they are composed of a certain quantity of being and an infinite quantity of non-being. To the extent that they participate in being, they participate to a certain degree also in the three *primalitates*. Thus every being exists because it can exist, and because it knows and loves itself. The three divine *primalitates* act in the world through the three *influxus magni*: Power expresses itself as Necessity, Wisdom as Fate and Love as Harmony. It is in the light of this theory that Campanella examines the most difficult questions of philosophy and theology, such as human freedom, divine providence, and the existence of evil.

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GERMANA ERNST

Cantor, Georg

Georg Cantor (1845–1918) was one of a group of late 19th-century mathematicians and philosophers, a group which includes Gottlob Frege, Richard Dedekind (1831–

1916), and David Hilbert, who transformed both mathematics and the study of its foundations. Cantor received a doctorate from the University of Berlin in 1866, and his habilitation from the University of Halle in 1869. He began teaching as a *Privatdozent* in Halle at the same time, and acceded to an extraordinary professorship there in 1872. He was created ordinary professor in 1879, remaining at Halle until his eventual retirement in 1913. He seems to have had very little contact with Frege, apart from writing a review of Frege's *Grundlagen*, and only passing contact with Hilbert, mainly by correspondence. He was, however, extremely close to Dedekind, and two significant periods of correspondence survive.

The supreme philosophical interest of Cantor's work is three-fold. First, although collections of objects had been relied on in mathematics at least since Euclid (3rd century BC), it was Cantor above all who turned sets (or *Mengen*) into an object of mathematical study in their own right, although the important contributions of Bernard Bolzano and Dedekind to this end should also be noted. Second, and in connection with this, Cantor created a mathematical theory of the infinite, in particular the theory of transfinite numbers. Third, he was the first to indicate that it might be possible to present mathematics as nothing but the theory of sets, or at least to push in this direction. If this can be done, then set theory becomes, in effect, the study of the basis on which mathematics is founded. This view has had a profound effect. For one thing, it contributed substantially to the movement, propelled by Frege, Dedekind, Hilbert, Bertrand Russell, and L. E. J. Brouwer (1881–1966), in their different ways, that the foundations of mathematics should itself become an object of mathematical study. For another, the view that mathematics is *nothing but* set theory has been of some importance, whether it is taken in the strongly reductionist sense, according to which all mathematical objects are sets, or merely encapsulated in the view that, although mathematics may not be just about sets, nevertheless for some foundational purposes (e.g., arguing about consistency) we can replace all objects by set-theoretically defined ones. This view of set theory as the foundation for mathematics has had considerable impact, although it has been challenged both by the view that mathematics has *no* foundations, and, in recent times, by the emergence of other universal theories, for example various forms of category theory.

Although it lacks the mathematical precision of both the earlier and some of the later works, Cantor's long and discursive paper of 1883 (the "Grundlagen einer allgemeinen Mannigfaltigkeitslehre") is, in many ways, his most important paper, for it makes clear why set theory took the direction it did in the early part of the 20th century, and it mounts a defence both of conceptual innovation in mathematics in general and of the mathematical theory of infinity in particular. All of Cantor's most philosophical writings make it clear that he derived enormous stimulus from philosophical writings on the nature of the infinite, especially those of Aristotle, René Descartes, Spinoza, Locke, and Leibniz, and particularly of Catholic philosophers and of the Church Fathers.

The doctrines he expresses concerning the infinite can be summarized as follows. Before Cantor, it was thought that there are only two kinds of infinity, what Cantor calls *potential* infinity and *absolute* infinity, a notion which Cantor claims to have taken over from the scholastic philosophers. The latter concerns fixed or *actual* infinity, but was taken to be a metaphor or a symbol of the Almighty, and thus of necessity to be beyond any kind of mathematical treatment. There is no doubt that potential infinities, which arise when quantities are regarded as finite but unbounded, are indispensable in mathematics; certainly the two basic kinds of number concept, that of natural number and that of real number, are potentially infinite in this sense, even though each individual number is finite. But it was thought that this is the only way that infinity enters mathematics. Indeed, we might regard the work of Augustin-Louis Cauchy (1789–1857) and Karl Weierstrass (1815–97) as showing how to dispense with infinite quantities in the calculus.

However, Cantor claims that the concept of potential infinity is not self-sufficient. His argument is simple, namely that potential

infinities presuppose pre-existing actual infinities, the point being that any variable presupposes a fixed domain of variation over which it ranges. Therefore, according to this argument, actual, and not just potential, infinities are indispensable in mathematics, and hence, we are owed a theory of these. Accordingly, Cantor replaces the identification of absolute infinity with actual infinity. He divides the actual infinite into the *increasable* (i.e., the numerable), which he calls the transfinite, and the *unincreasable*, and claims that only this latter is beyond mathematical determination, beyond numbering in particular. Any reasonable theory of the increasable infinite requires, naturally, a theory of infinite number, something that had encountered stiff philosophical resistance hitherto. However, Cantor argues that there is nothing contradictory about such a theory, and shows that putative demonstrations of inconsistency invariably start from a hidden assumption that there can only be numbers with the standard properties that the natural numbers have. In other words, he claims that such demonstrations *presuppose* the unacceptability of infinite numbers.

Nevertheless, the notion of a mathematizable, increasable infinite only makes sense if it can be shown that there are indeed actual infinities with different mathematical properties, especially numerical properties. Nothing in Cantor's philosophical defence shows why a mathematical theory of infinity, including a theory of infinite number, might be needed, and therefore ought to be taken seriously philosophically. However, that there is a need is clear from various discoveries made by Cantor himself before 1883.

The first mathematical stimulus for the separate study of infinite sets came from Cantor's work in the theory of the representation of functions of one real variable by trigonometric series. Cantor had shown that if such a series $S(x)$ converges to a given function $f(x)$ for every value of x, then that series must be unique. But what if there are exceptional values of x, places where the series does not converge, or at least, not to the function? Is the general representation of f by trigonometric series still unique? Cantor showed that the existence of a finite number of exceptions to this representation does not affect the uniqueness. But in trying to extend this result further, Cantor studied the exceptions collected together to form a point set (*Punktmenge*). The result of his investigation (published in 1872) was that a series representation of a function is unique if we assume that the set of the exceptions to this representation, although it can be *infinite*, satisfies a certain property, namely that its nth derived set vanishes for a finite n.

This sounds very technical, but there are several things to notice about it. The first is quite elementary, but none the less fundamental in the light of Cantor's (later) categorization of the infinite given above, for the work treats of sets of points which may well be infinite, and it assumes crucially that these sets can have important mathematical properties. In other words, it assumes that sets are themselves mathematical objects, even if they are actual infinities. Moreover, there is something arbitrary about the sets considered, in the sense that it is not claimed that there is any 'form' holding the points of the set together, certainly nothing like a geometrical unity binding the elements of the set. It is important to note that Cantor's work on this was accompanied by an arithmetic characterization of real numbers, using Cauchy sequences of rationals. In this way, the continuum becomes something wholly abstract, a collection of abstractly defined numbers, and not something dependent on geometrical properties, certainly not on those stemming from geometrical intuition. Cantor's definition of real number was given at the same time and independently of Dedekind's abstract characterization via cuts in the sequence of rationals also published in 1872. The two definitions became basic to mathematical analysis.

The second thing to notice about Cantor's early work is that it is essentially an investigation of how to characterize *negligibility* mathematically. For the question underlying this investigation of trigonometric series might be framed as: when is the set of exceptions to a representation sufficiently negligible not to affect the uniqueness of the representation? It was known, since

Cauchy's work on integration, that a finite collection of exceptions can be regarded as negligible. But what Cantor makes clear is that finitude is not a necessary condition of negligibility, the study of which became important to late 19th-century mathematics.

This leads us to the use of the derived sets themselves, by which Cantor more or less created point set topology. The Bolzano–Weierstrass theorem says that every bounded infinite set has at least one accumulation point, called a *limit point* by Cantor. What Cantor does is to collect all these accumulation points into a set, the first *derived set* of the starting set P. This derived set may well be finite, in which case it can have no accumulation points itself. But it may be infinite, and will be bounded if the original set P is. Then it, too, will have accumulation points, collecting these leads to the second derived set, and so on. Clearly, specification of the index at which the derived sets eventually vanish, if at all, can express important information about the distribution of the points in the original set P. For instance, we may regard an accumulation point as a point around which members of the original set are heaped up (hence the name), so the first derived set is the set of all these points, and thus contains information about the distribution of members of P. The second derived set then tells us about the distribution of the accumulation points themselves, and so on. Thus, the order of derivation at which the derived sets first vanish, if at all, may be taken as a measure of the denseness of the points of the original set P. (We will come back to derived sets below.)

In sum, what this work shows is that there is a solid mathematical point to studying actually infinite sets. But there is nothing in this so far to indicate that the infinities involved can be discriminated *numerically*. The second stimulus for the study of infinite sets, Cantor's celebrated work of 1874, shows that this is indeed the case.

The real numbers fall naturally into two groups, the rational numbers and the irrationals. But there is another traditional way of dividing them, namely into the algebraic numbers, that is, those numbers x which can be expressed as the solution of an algebraic equation with natural number coefficients, and the transcendental numbers, those which cannot be so expressed. Thus, $\sqrt{2}$, although irrational as the Greeks knew, is clearly algebraic, for it is the root of the equation $x^2 - 2 = 0$. The algebraic numbers, of course, include the rational numbers (for any rational number p/q, p and q being natural numbers, we have the equation $qx - p = 0$), although the algebraic numbers seem to be a much more extensive class. Indeed, although methods for the construction of arbitrarily many transcendental numbers in a given interval were given as early as 1844, it was not known whether any of the numbers standardly treated in analysis is transcendental until 1873, when Charles Hermite (1822–1901) proved that e is. (π was proved transcendental by Carl Lindemann (1852–1939) in 1882, thus finally showing that it is impossible to 'square the circle' by elementary constructions, for any 'constructible' number must be algebraic.) Thus, before Cantor's work of 1874, there appeared to be very few transcendental numbers.

However, Cantor proved that, although the algebraic, and hence the rational, numbers can be put into one-to-one correspondence with the natural numbers, the same cannot possibly be true of *all* the real numbers. In other words, as we would now say, the real numbers are *uncountable*. Indeed, there are 'as many' transcendental numbers as there are real numbers altogether. (Cantor gave another, simpler proof of the uncountability of the reals in 1892. The proof relies explicitly on the so-called diagonal argument, a form of argument which has become classical in modern mathematics.) It follows from Cantor's argument, as he says somewhat cautiously, that there is a 'clear difference' between the whole continuum and totalities like that of all algebraic numbers. This was followed in 1878 by the discovery that it is possible to establish a one-to-one correspondence between any 1-dimensional interval of real numbers and any interval of real numbers of dimension n, a result which prompted Cantor to write to Dedekind: "I see it, but I don't believe it".

All the collections involved here are infinite. Thus, the first thing Cantor's result

establishes is that there are at least two different kinds of infinity exhibited among the real numbers, countable and uncountable infinity. This immediately gives another way of classifying sets in addition to considering their patterns of derivation. It also raises one of the most celebrated questions in modern mathematics: are there any further kinds of infinity represented in the continuum of the real numbers? This became known as the *continuum problem*. Cantor's conjectured answer to this in 1878 was that there are indeed only two infinities so represented, and this answer has become known as *Cantor's continuum hypothesis*. The continuum problem appeared first on Hilbert's famous list of problems in 1900, and it still remains unsolved in any positive sense. (Work by Kurt Gödel in 1939 and work by Paul Cohen in 1963 together show that the problem is insoluble from the set-theoretic axioms used today.)

The 1878 paper does something else, for it proposes to define the differences in 'kinds' of infinity as stemming from differences in size. Two manifolds (or sets) are said to be of the same *power* or (cardinal) size, just in case they can be put into one-to-one correspondence. (We should note that this criterion of size had been proposed by Bolzano but was not developed by him.) In a certain primitive sense, this criterion is natural, for it is natural to say that there are the same number of people as seats in a stadium if and only if every person present occupies one and only one seat and there are no seats left over. But while this criterion is unproblematic for finite collections, it means facing certain, at first sight counterintuitive, consequences as far as the application to infinite collections is concerned. For it implies that the collection of all squares of even numbers, the collection of all even numbers themselves, the collection of all rational numbers, and indeed the collection of all algebraic numbers, are all 'of the same size' as the collection of natural numbers. That is, the collection of all natural numbers is of the same size as collections which are both much less extensive and collections which are more extensive. Cantor's achievement at least partly lies in showing that, while there might be some counterintuitive consequences in adopting this criterion, these are by no means contradictory.

The work of 1874, looked at in the light of the 1878 definition, now shows unequivocally that there is a point to studying the *numerical* properties of infinite sets mathematically, and that there are numerically increasable actual infinities at the heart of ordinary mathematics. Indeed, in some sense we might think of Cantor's work subsequent to 1880 as showing that:

1. There are infinite cardinal *numbers* which can stand as the arithmetical representatives of power or size for infinite sets.
2. These can be characterized in such a way that the arithmetic which ensues can solve the continuum problem.

At this juncture, it is important to mention that the focus on point sets, and the discovery that there is a difference between countable and uncountable infinities, had a profound effect on the mathematics of the late 19th, and of the 20th, centuries. Indeed, it is safe to say that analysis and algebra, the theories at the core of late 19th-century mathematics, were transformed by the techniques first made available by Cantor's work and discoveries. For one thing, the concentration on arbitrary collections of points, and their treatment as mathematical objects, quickly effected crucial transformations in the way that standard mathematical concepts, like that of the integral of a function, were dealt with. For another, the creation of point set topology, loosely, the study of the real numbers from the perspective of those properties involved in continuity, as opposed to those involving the continuum's metric structure, was of the greatest importance. And in all these developments, the distinction between the countable and the uncountable is fundamental, certainly in any attempt to characterize negligibility. But, in addition to the way it aided concept formation, the basic move away from geometrically intuitable forms to arbitrarily given and abstract point sets makes possible the shift from more

concrete to more abstract mathematics. Thus, in general topology one gradually loses sight of sets of real numbers as providing the basis, and accepts any sets whatsoever. Similarly, in algebra, concentration shifts from the kinds of algebraic structure exhibited by the standard mathematical forms to algebraic structures based on arbitrarily given sets. In both shifts, the concentration thus falls naturally more on 'form' (not geometrical form) than on 'essence'. Cantor was certainly not the only one driving this movement; but it is fair to say that his discoveries were fundamental.

Let us now turn to Cantor's creation of a numerical theory of the infinite. The first approach takes us back to the derived sets. The work of 1872 considers those point sets P for which there is an n at which the derived sets vanish. But what if a set is such that the derived sets of finite order do not vanish? There will be such sets, as Cantor shows, but a finer analysis of these is only possible if there is some means of continuing the process of derivation beyond the finite, and this in turn will only be possible if there are means of indexing this process. Thus, in 1880 Cantor introduces what he later called 'symbols of infinity', the symbols '∞', '$\infty + 1$', etc. Given these, the first derived set of *infinite* order, the set P^{∞}, is defined to be the intersection of all those of finite order, the next one, $P^{\infty+1}$, the derived set of this (i.e., $(P^{\infty})^1$), and so on. It is fairly clear that Cantor hoped that the flexibility furnished by these symbols would provide a classification of point sets discriminating enough to yield conclusive information about their powers, and thus to solve the continuum problem. Indeed, Cantor begins to show how derivation properties are connected to a set's power. As we know, the study of derivation did not lead to a solution of the continuum problem. However, it did lead Cantor to establish a close connection between the symbols and power.

The treatment of the symbols *as* symbols is clearly anomalous mathematically, for their combination with natural numbers presupposes that the two are objects of the same kind, hence subject to the same general arithmetical laws – in short, that they are both numbers. Thus, in the 1883 paper already mentioned, Cantor takes the crucial, but requisite, step of reintroducing these symbols as symbols for *transfinite ordinal numbers*. This is fundamental, both for the attempt to isolate the conceptual basis the new transfinite numbers share with the natural numbers, and hence for the attempt to isolate general arithmetical laws which they both obey, and for the use of these ordinals to give a general characterization of the various powers.

Cantor 'creates' the new transfinite numbers by three generating principles. The first involves just the adding of a new 'unity' to an existing number (taking successors, in other words). Starting from 0, this generates the first number class (I), the natural numbers. The second is a kind of limit process; given any infinite and unbounded sequence of increasing numbers, we 'create' a new number which is to be the limit of this sequence, i.e., a number which is the next greatest after all the elements of the sequence. This guarantees the existence of ω, the 'limit' of the class (I). The first principle then guarantees all the numbers $\omega + n$, and the second principle then gives $\omega + \omega$, and so on. The third principle is a principle of restriction, as Cantor calls it, for it constrains the first two principles. The natural numbers form the first number class, hence its power is just that of the natural numbers. (Cantor assumes here that this power is the smallest infinite one.) Each of the numbers 'generated' by the first two principles then has the property that the collection of all numbers less than it has the power of the class (I). Collect all these numbers, and call this 'the second number class', the class (II). The second principle then guarantees that there is a number following first after all these, the first number after (II), the number we know as ω_1. Clearly, the collection of all numbers before this has the power of (II). Thus let (III) be the class of all numbers whose set of predecessors has the power of (II); this yields the number we know as ω_2, and so on. Cantor gives a proof that the power of (II) is greater than that of (I), and that there is no power in between. Thus, the power of (II) is the next infinite power after that of the natural numbers. Cantor does not prove an ana-

logous result for (III), but it is clear that he assumes it. In fact, he conjectures that the sequence of powers produced by this method (though it is by no means clear how far it goes) represents all possible powers, and states that the numbers that are used to produce this sequence have just the same 'objective reality' as the numbers already accepted as existing. These results, together with the proof of 1874, now show that there are two powers greater than that of (I), that of the continuum and that of (II). If that of the continuum were bigger than (II), there would be at least three kinds of infinity represented in the continuum, thus violating Cantor's original conjecture. Hence, in this framework the conjecture becomes just the assertion that the continuum has the same power as (II), as Cantor asserts.

The steps taken in this 1883 work form the basis of modern set theory. Cantor shows *why* both the old finite, and the new transfinite, numbers are numbers of the same basic kind (that the two have the same objective reality') in that they both arise rom, and express, an underlying well-)rdering on the sets that they are to number. The difference is that only one such ordering (and hence only one number) is possible on a finite set of elements, whereas there are many possible orderings of a given infinite set of elements, say the natural numbers. Well-ordering generalizes the discrete, linear ordering characteristic of finite sets, with the difference that, as well as a first element, to every increasing sequence of elements (in a set) there is a unique, smallest element which follows next after all the members of the sequence, providing that there are elements left over. Well-orderings, when thus characterized, clearly mirror the way the transfinite numbers are introduced by the generating principles. (Cantor's definition is also clearly equivalent to the definition we use now.) It is also clear that well-orderings are what arise if we undertake to count the elements of a set, that is, to enumerate the elements, one by one. Cantor's explanation of why both the finite and the transfinite ordinals are both *numbers* thus ties the notion of ordinal number firmly to the notion of set, for the way sets behave becomes the crucial matter. Even without the claim that numbers can actually be reduced to sets, there is still the (weaker) claim that laws governing numbers reflect laws governing well-ordered sets.

But the way powers are introduced above makes it clear that they, too, depend on well-ordered sets, for the ordinal numbers themselves, and hence the members of the successive number-classes, clearly form well-ordered sequences. These powers are thus the powers of all well-ordered sets only if we accept that every well-ordered set can be enumerated by an ordinal number. To claim that all transfinite powers are represented in the sequence of number-classes is then to claim that every set is capable of being rearranged in well-ordered form, a claim that became known as the well-ordering theorem, an assertion which Cantor called both 'basic' and a 'law of our thinking'. The theory of cardinality proposed by Cantor is thus essentially a counting theory, and the theory of ordinality and the theory of cardinality are nicely linked, both forming generalizations of counting and numbering for finite sets. (Note that, although enumerating infinite sets, assuming that this is possible, can lead to any one of a large collection of ordinal numbers, all of the numbers arrived at will be in the same number-class. Thus this class will also give the cardinal number of the set being enumerated, just as counting – arranging in a well-ordered sequence – establishes the size of finite sets.)

The approach to cardinality in Cantor's 1883 paper is basic, although the work of 1895 gives the impression of being much more general. First, Cantor now calls powers *transfinite cardinal numbers*, and he introduces the first letter of the Hebrew alphabet, the letter aleph ($\aleph$), to denote the cardinal numbers of the number-classes. (Thus $\aleph_0$ is the cardinality of the first class, $\aleph_1$ that of the second, and so on.) Second, Cantor gives what is often taken to be a quite general characterization of set, and claims that cardinal numbers arise from any set by a two-fold act of 'abstraction', abstracting first from the nature of the objects and then from the order in which they are given. (Numbers expressing order supposedly arise by abstracting only from the nature of the objects.)

This seems to suggest that Cantor was reluctant to rely on ordinal notions as he had before. He gives general definitions of the basic arithmetical notions – addition, multiplication, and exponentiation – and hence succeeds in casting the continuum hypothesis in its third, and best known, form, namely that $2^{\aleph_0}$, which is the cardinality of the continuum (a fact which can be seen by taking binary, instead of the usual decimal, expansions of real numbers), is identical to $\aleph_1$. The continuation in 1897 also considers ordinal numbers as a more specific kind of 'order type', taken to be representatives of any linear orderings. A good deal of the appropriate arithmetic for these is also given.

However, the suggestion that ordinal notions are avoided is misleading. First, Cantor tries to give a theoretical account (via the notion of abstraction) of *how* numbers are tied to sets, thus trying to elaborate the connection which had emerged in his 1883 work. Second, Cantor's correspondence from this time makes it clear that he still adhered to the ordinal theory, for he claimed (and attempted to prove) that all cardinal numbers are represented in the series of alephs. Indeed, Cantor apparently identified the cardinal numbers $\aleph_\alpha$ with the initial ordinals ω_α, something which, since John von Neumann (1903–57), is the modern convention.

It is often said that Cantor's set theory is naïve, in that his characterization of set is so general that it will lead fairly directly to the famous antinomies. However, the situation is not straightforward. First, it is not at all clear that Cantor's best known 'definition' (from 1895) permits the extension of any property to be a set, something which is apparently needed if we are to form the sets involved in the antinomies. Second, Cantor gives another definition (in 1882) which is explicitly much more limited than this. Third, Cantor's doctrine of the absolute infinite provides some protection against the formation of the known antinomic sets, for these might each be thought of as embodying an attempt to mathematize absolute infinity, in particular to ascribe to it numerical properties. It is clear from his late letters to Dedekind that Cantor was concerned to articulate explicit set existence principles which accord with his doctrine of absolute infinity and which rule out the kind of set formation which appears in the antinomies.

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MICHAEL HALLETT

Carnap, Rudolf

Rudolf Carnap (1891–1970) was one of the leading members of the Vienna Circle. The latter was originally more of an informal group than an organized philosophical school. It came into being formally in the early 1920s when Moritz Schlick (1882–1936) arrived in Vienna. Its members thought of themselves as continuing the 19th-century Viennese empirical tradition of Ernst Mach and Ludwig Boltzmann (1844–1906). On the philosophical side the members of the Vienna Circle, besides Schlick and Carnap, were Otto Neurath (1882–1945), Herbert Feigl (1902–88), Friedrich Waismann (1896–1959), Edgard Zilsel (1891–1944), and Victor Kraft (1880–1975); on the mathematical side Philipp Frank (1884–1966), Karl Menger (1902–87), Kurt Gödel (1906–78), and Hans Hahn (1879–1934). In 1929 the circle published its manifesto entitled "Wissenschaftliche Weltauffassung: Der Wiener Kreis", which gave a brief account of the philosophical position of the group. In 1930 the Vienna Circle took over the journal *Annalen der Philosophie*, renaming it *Erkenntnis* and making it the principal organ of the positivist movement. The Vienna Circle also organized international congresses at Prague, Königsberg, Copenhagen, and Paris. During the 1930s the Vienna Circle disintegrated as a group.

The missionary spirit of the circle found its expression in the common attack on meta-

physics. Metaphysical assertions were said to be meaningless, since there was no way of verifying them in experience. The Viennese positivists rejected Aristotelian ontology as well as the Kantian *'a priori'*. Carnap allowed, however, that metaphysical writings might have poetic merit, or express specific attitudes to life.

In their application of Ockham's razor the members of the Vienna Circle were more pragmatic, and ontologically far more tolerant, than is commonly assumed. It seems that their rejection of metaphysics had primarily a political or anti-ideological function (E. Köhler, in Dahms 1985).

Ontological Questions. The members of the Vienna Circle did not agree among themselves about ontological issues. Schlick, e.g., was not a strict positivist or phenomenalist. In his *General Theory of Knowledge* (1918) he even devoted two chapters to confuting phenomenalism and to defending realism. Only after he came under the influence of Carnap did he look on the issue of realism versus phenomenalism as a metaphysical pseudoproblem. Neurath, in contrast to Schlick, was a Marxist. As such he could not be sympathetic towards phenomenalism, since Lenin (1870–1924) had attacked Mach's positivism declaring it to be a form of bourgeois idealism. Neurath accordingly tried to influence Carnap towards accepting physicalism.

Carnap held at the time of the Vienna Circle that ontological issues are pseudoproblems for they cannot be solved by scientific procedures. His views on ontology have to be understood against the background of the conventionalism of Jules Henri Poincaré (1854–1912) and Hugo Dingler (1881–1954) and David Hilbert's formalism. Carnap held that there are equally valid alternative ways of describing the world. The one commonly chosen is not said to be *truer* than the others, but simpler or more convenient. Carnap's dissertation *Der Raum* (1922) and his main work *Aufbau* (1928) can be seen as an anticipation of his views on ontology in *Empiricism, Semantics, and Ontology* (1950) with its distinction between internal and external questions, i.e. between questions of the existence of certain entities within a given system and questions concerning the existence of the system of entities as a whole.

The concept of reality at work when we ask internal questions is an empirical or scientific one. To recognize something as real or existent in this sense means to succeed in incorporating it into the system of things already recognized as real. Those who raise external questions concerning the system itself, now, do not raise theoretical but practical questions, matters of practical decisions concerning the structure of language. According to Carnap, we are free to choose any linguistic framework. There are no scientific or theoretical constraints on our decisions. It is practical efficiency, fruitfulness, and simplicity of the use of one language rather than another which are decisive. Ontological questions concerning the existence, e.g., of abstract entities, are accordingly questions whether to use certain linguistic frameworks or whether to use variables in addition to those we have for common things.

Carnap's Conventionalism. Carnap's early works display a strong conventionalist trait. As there is more than one geometry, depending on the choice of axioms, so there are various empirical languages for describing our world. The axioms of geometry are said to be conventions and as such neither analytically nor empirically true. No geometry can be refuted by experience. In *Der Raum* (1922) Carnap aims to demonstrate the possibility of choosing a Riemannian space structure that is different from the established Euclidean one but nonetheless adequate for describing observational facts about the world. Observable states of affairs or phenomenal contents do not force us to choose one particular geometry or language system rather than any other.

Carnap held also that there are no theoretical means for deciding whether to accept a physicalistic or phenomenalistic ontology, in this respect anticipating W. V. O. Quine's theories of 'ontological relativity' and 'underdetermination of theories'. In his autobiography Carnap says that this neutral attitude towards language systems or ontologies has remained the same throughout his life: "It was formulated as 'principle of tolerance'

in *Logical Syntax* and I still hold it today, e.g. with respect to the contemporary controversy about a nominalistic or Platonistic language" (in Schilpp 1963).

Carnap's Constructional System and Formalism. Carnap's *Aufbau* (1928) is an attempt at a constructional system, i.e., at a construction of the various types of 'objects' from the small basis of 'the given'. Carnap had envisaged the potential philosophical force of the constructional method when he tried in his essay "On the dependence of space-properties upon time-properties" (1925) to construct the topological properties of space from the topological properties of time or from the basis of the 'earlier than relation'. The ontology of any constructional system is determined by its 'basis'. Only the basic elements are genuine objects with a non-fictive status. All other constructed 'objects' are 'quasi objects' or classes of primitive objects.

The common characterization of the *Aufbau* as phenomenalistic might be misleading, since the elements of its basis differ strongly from 'sense data' as envisaged in the British tradition. Because of Gestalt theory Carnap chose as primitive elements indivisible total experiences. They form together with a dyadic similarity relation holding between them an extremely convenient constructional basis. Carnap constructs first similarity circles, from them quality classes, and then sense impressions as ordered pairs of total experiences and quality classes. For the higher constructional steps, e.g. for the physical objects, Carnap provides only sketches of how they might be carried out. Nelson Goodman shows in his *The Structure of Appearance* (1951) the advantages of Carnap's constructional method as a process of abstraction, but also its difficulties – which he describes as "virtually disastrous" for the *Aufbau*, e.g. the "companionship difficulty" and the "difficulty of imperfect community". The former consists in not obtaining enough qualities, the latter in getting too many.

In his preliminary discussions of the *Aufbau* Carnap centres on the problem of objectivity. It was Carnap's and Schlick's conviction that the essential feature of objective expression or symbolization is structure. What matters is merely the structure of the signs, since what can be communicated is only structure. The qualitative content of sensory experiences remains incommunicable. Carnap defends the thesis that scientific statements in their most advanced form speak of mere structures without stating what the elements of these structures are. The more a science advances, the more its objects cease to be 'content' and become 'form'. The ontological basis of his constructional system is therefore ultimately the dyadic similarity relation. The primitive ontological elements are relations or structures.

This standpoint is carried further by Carnap in the *Syntax* (1934). In the formalist stage of his Viennese philosophy Carnap thought that he could dispense with semantic relations between expressions and observable states of affairs. If ontological assertions do make sense they have to be considered as statements about language or syntactical structures. To understand them rightly we have to translate them from the 'material mode' into the 'formal mode', i.e., into sentences about words and the rules governing the use of words.

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EDMUND RUNGGALDIER

Cassirer, Ernst

Ernst Cassirer was born in Breslau in 1874. He died in New York in 1945. From 1892 he studied jurisprudence at Berlin, then literature, art, and philosophy at Leipzig, Heidelberg, and again at Berlin. There Georg Simmel (1858–1918) pointed him towards the neo-Kantian Hermann Cohen (1842–1918) at Marburg. Already during his time as a student, Cassirer had worked on the history of mathematics and physics. In 1896 he went to Marburg, where he took his doctorate as a student of Cohen and Paul Natorp (1854–1924) in the year 1899. His dissertation on René Descartes's critique of mathematical and physical science constitutes the first part of his first book on the scientific foundations of Leibniz's system (*Leibniz' System in seinen wissenschaftlichen Grundlagen*, 1902).

Cassirer took his habilitation in 1906, having finished the first volume of his study of the modern history of epistemological problems, which later on was to become the four-volume work *Das Erkenntnisproblem in der Philosophie und Wissenschaft der neueren Zeit*. In 1919 he was appointed to a professorship at the University of Hamburg. Cassirer left Germany because of his Jewish origin in 1933 and spent his final years in Sweden and the United States.

The development of Cassirer's conception of a 'philosophy of symbolic forms' stated about 1918 via his Kantianizing approach to epistemological questions and to the philosophy of science, through his research in the history of philosophy, and through his analyses of problems of the physical and cultural sciences. This development culminates in his *Philosophie der symbolischen Formen* (three volumes, 1923, 1925, and 1929).

A preliminary version of the concept of symbolic formation can be seen in the theory of natural science and epistemology developed in the book *Substanzbegriff und Funktionsbegriff* (1910). In modern physics Cassirer finds the decisive tendency in a move from the concept of substance towards the concept of function. This means: concepts in the physical sciences do not simply refer to objects; they rather express the activities by which humans orientate themselves and which are operative in their research. Thus concepts such as 'mass', 'atom', 'energy' are to be understood as symbols. In 1920, Cassirer expressly formulated the concept of symbolic forms in his book on Einstein's theory of relativity.

The concept of symbolic forms comprises the whole range of the forms which are involved in our comprehension of the world. It is a concept which cannot be underpinned by any 'metaphysical unity'. The starting-point is rather the multidimensional 'functioning of cognition and consciousness' on the part of the individual human being within a culture. Cassirer's work on the conceptual form of mythical consciousness also shows this functional character of conceptual formation: the starting-point must not be the character of things, but characteristics of thinking (as acting).

Symbolic formation means accordingly any correlation of a sensible substrate with a non-sensory meaning. This correlation is performed functionally by human consciousness, and it is, as far as man is concerned, prior to any reality. Different kinds of such formations become manifest in such different cultural dimensions as, for example, language, myth and religion, the arts, technology, and science. Conversely, these cultural dimensions and their claims to reality can be understood only by retracing the corresponding spiritual or intellectual energies, the corresponding intellectual

work of the human being. Cassirer believes himself to have fulfilled hereby the Kantian demand that the proud name of ontology must make room for the modest name of a mere analytics of the pure understanding (*Critique of Pure Reason* B 303; cf. *Erkenntnisproblem* II, p. 682). But Cassirer tried to enlarge the programme of such an analytics in such a way that it would comprise the whole range of our understanding of the world. The human sciences (*Geisteswissenschaften*), which reached a degree of self-assurance only in the 19th century, are thus brought within the reach of this analytics of the understanding, so that the critique of reason becomes a critique of culture. Metaphysics and ontology are replaced by a new conception of a philosophy of culture. Reality is conceived as the reality of the human being, which understands itself as a totality of symbolic formations in the sense of a functional correlation of sensibility and meaning. What is at stake here is not the formation (*Gestaltung*) *of the* world, but rather – in the sense of the Platonic γένεσις εἰς οὐσίαν – a giving of form *to the* world. Even the concept of truth, which is only a case of the concept of meaning, is relativized in such a way that it can only be understood via a philosophical consideration of the processes of symbolic formation and according to a theory of systems and functions.

Cassirer's late work, *An Essay on Man* (1944), shows especially that any possible unity of reality is rooted in the human being as an *animal symbolicum* that is able to create a 'symbolical universe' through symbolic formation. Nevertheless, it is not possible to ascribe any substantial unity to the human being itself. The unity of the latter becomes manifest only in its cultural achievements, in the energy of its multidimensional creativity and understanding of the world. Accordingly, the human being can only recognize itself in the mirror of culture. And there is nothing to be found behind this mirror. Within these cultural achievements Cassirer nevertheless sees the possibility of the development of an ethical attitude and of our practising our freedom responsibly. The question remains whether Cassirer's explicit rejection of the ontology and metaphysics of substance, or whether his opinions, especially manifest in his semiotic perspective which sometimes reminds one of nominalism, are not in fact replaced by a metaphysics of cultural-anthropological activism. Cassirer seeks to bind this activism of culture ethically. His repeated attempts to establish the foundations of ethics in the spirit of critical idealism call to mind attempts to furnish a proof of the existence of man in a time when the attempt to prove God's existence presents itself as outworn metaphysics.

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ERNST WOLFGANG ORTH

Catastrophe Theory

The starting-point of catastrophe theory was the search for a mathematical description of morphogenetic fields in biology by René Thom in 1966, taking up ideas introduced into theoretical biology by C. H. Waddington (1907–75) (Thom 1983, pp. 13–38). Thom applied the abstract schemata of the theory of structural stability of differentiable mappings to which he had contributed in the 1950s and early 1960s. Where the classical fields for the application of these mathematical results had been geometrical optics and hydrodynamics (e.g. wave fronts), Thom considered "more speculative but nevertheless useful" applications in physiology, neuron activity and in "a geometrical theory of language, of meaning" (p.14). Christopher Zeeman joined this endeavour, and proposed a series of applications of catastrophe theory to the description of animal behaviour, perception and brain dynamics (Zeeman 1977).

Basic Concepts of Catastrophe Theory. A catastrophe is a type of instability in a simple

dynamic system whose unfolding is structurally stable. Examples of commonly experienced catastrophes are sudden changes in a real system, e.g. switches between two states in a buckling plate or the breakdown of stability as in a bridge which crumbles.

Elementary catastrophe theory considers gradient systems, i.e. systems governed by attractors which are isolated points (every trajectory in these systems goes almost instantaneously to stable states) and it applies the classification theorem due to Thom and Mather. The following list shows the name of the singularity, the 'germ' in mathematical terms, the number of internal or state variables (the corang), and the number of external or behaviour variables in the unfolding of the singularity (the codimension); the type refers to a general classification due to V. L. Arnol'd. This list follows from the classification theorem if only simple singularities (in the sense of Arnol'd's definition) with codimension up to 4 are considered.

Name	*Germ*	*Corang*	*Codimension*	*Type*
fold	x^3	1	1	A_2
cusp	x^4	1	2	A_3
swallow tail	x^5	1	3	A_4
butterfly	x^6	1	4	A_5
hyperbolic umbilic	$x^3 + xy^2$	2	3	D_{+4}
elliptic umbilic	$x^3 - xy^2$	2	3	D_{-4}
parabolic umbilic	$x^2y + y^4$	2	4	D_5

The 'cusp' and 'butterfly' catastrophes are central for most of the applications. In order to specify the dynamic behaviour of specific models, it is necessary to make further assumptions concerning the behaviour in the neighbourhood of the catastrophic 'jump'. For this purpose two basic conventions are introduced, which mirror the behaviour of very rigid, conservative systems as opposed to very 'nervous' systems:

The *convention of perfect delay*. If the system is in a stable state (attractor) it stays there until this state disappears (in a fold catastrophe).

The *Maxwell convention*. If the system has the choice between two or more stable states, it prefers the optimal state (in the case of a negative gradient system this is the deepest attractor). The points at which two stable states are equally deep are called Maxwell-points; in the models a transition through these points is called a conflict catastrophe.

In the case of delay, the system shows a hysteresis effect, i.e. the jump depends on the direction of the process and in the case of a cyclical process two different jumps are observed. Those systems which are better described by the use of the Maxwell convention may be interpreted as having a stochastic component.

Recent Developments in Catastrophe Theory. The mathematics applied in catastrophe theory has rapidly evolved since the 1960s. Chaos theory and the theory of fractals have appeared and applications of stochastic dynamic systems (mainly synergetics and the theory of dissipative systems) now rival those of catastrophe theory. As the mathematical results applied in catastrophe theory are still the kernel of all such work, Arnol'd (1986) has extended the label 'catastrophe theory' to the whole field. Thom himself has continued his research in theoretical biology, semantics, and natural philosophy and has proposed a common framework for theories of nature, mind, and signs, which he calls 'semiophysics' (Thom 1988).

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WOLFGANG WILDGEN

Categorial Grammar

Categorial grammar has its origins in classical theories of parts of speech and in modern mathematical logic. The generally cited source is Kazimierz Ajdukiewicz (1890–1963), "Die syntaktische Konnexität" (*Studia Philosophica* 1, 1936), which drew on the logical practice of Stanisław Leśniewski, itself modelled on the practice of Gottlob Frege and on Edmund Husserl's theory of *Bedeutungskategorien*. Leśniewski's motivations were in part ontological: he wished to avoid commitment to Fregean functions or higher Russellian types. Ajdukiewicz's ideas were developed by Yehoshua Bar-Hillel (1915–75) and J. Lambek (b. 1922), but were long neglected in favour of transformational generative grammars. Following their use by R. Montague (1930–71), they have witnessed a recent revival, documented in the collections edited by Buszkowski *et al.* (1988) and Oehrle *et al.* (1988). Later studies have emphasized the mathematical analysis of grammars and their application to natural languages.

Categorial grammar has both a syntactic and a semantic aspect, and is usually prized for the simplicity of the connections between them. Consider first the syntactic aspect. A *simple categorial language* is one whose expressions are exhaustively and exclusively divided into substitution classes, *syntactic categories*, such that all expressions from any category are substitutable *salva congruitate* only for expressions of the same category. For example, the four-word 'language' consisting of the words 'John', 'Mary', 'runs', and 'sleeps', understood as in English, contains two syntactic categories, NAME and INTRANSITIVE VERB, the first two words belonging to the former category and the last two to the latter. We may form four distinct complex expressions of the category SENTENCE by putting a name before a verb. No other combination is grammatical. Some of the categories are *basic*. The most usual basic categories are those of SENTENCE (S) and NAME (N), though further categories such as COMMON NOUN and INTRANSITIVE VERB have been considered. *Functor categories* are then defined recursively starting from the basic ones. If $a, b, c, \ldots, n$ are categories, the functor category $a/bc\ldots n$ is the category of expressions which congruously combine with expressions of categories $b, c, \ldots, n$ (in that order) to form an expression of category a. The quotient notation is due to Ajdukiewicz, and is meant to facilitate calculation of categories of complex expressions; if an a/b and a b are combined we can 'multiply out' to an a. Expressions of functor categories are called *functors* and their inputs and outputs are often called, in analogy with function theory, *arguments* and *values* respectively. The form of combination may vary, though the most usual one is simple left–right concatenation. Often only binary combination is considered. In the simple example given, our basic categories are S and N, the verbs belonging to the functor category S/N, and combination is effected by preposing the argument to the functor. If we are not concerned with exactly how combination is effected, or if only one mode is used, the functor categories may be *undirected*, as above. *Directed* functor categories, introduced by Bar-Hillel ("A quasi-arithmetical notation for syntactic description", *Language* 29, 1953, pp. 47–58), specify whether the arguments combining with a functor are to be sought to the left or the right. Then a/b is the category of functor expressions which take as argument a b-expression to the right to form an a-expression, while an $a\backslash b$-expression yields a b-expression when an a-expression is added to the left. A complex expression (in most cases just a string of simple ones) is well formed or *syntactically connected* if and only if the sequence of its categories can be syntactically connected ('multiplied out') to a single category. The resulting sequence of nested combinations automatically generates a syntactic constituent-structure analysis for the whole expression.

Simple categorial grammars have their limitations when applied to natural languages, for one thing because many words appear in more than one category, e.g. many transitive verbs may also be used intransitively. Recognizing this, more recent work follows Peter T. Geach, Montague, and others in admitting *type-changes*, rules allowing an expression

of a particular category to be assigned a different category in context. According to Geach's Rule, an expression of category a/b may also be of $(a/c)/(b/c)$. For example in 'Everyone loves Mary' the quantifier 'everyone', category $S/(S/N)$, may be regarded as $(S/N)/((S/N)/N)$ to allow the phrase 'everyone loves' to be seen as a grammatical unit. According to Montague's Rule, an a-expression may also be of $b/(b/a)$, allowing the roles of argument and functor to be interchanged in binary combinations, which may be used to explain co-ordination phenomena, as in 'Custer and all of his men perished'.

It was noticed by Lambek ("The mathematics of sentence structure", *American Mathematical Monthly*, 65, 1968, pp. 154–69) that type-change rules may be read as inference rules, reading '/' as the converse of implication; so, Geach's Rule becomes the valid inference of prefixing transitivity:

$$b \to a \vDash (c \to b) \to (c \to a)$$

In this way different grammars are equivalent to various pure implicational calculi, and Lambek's method has been used to further investigate the mathematics and 'recognizing power' of categorial grammars.

Categorial languages are usually interpreted in a semantics in which each basic category corresponds to a class of basic entities (e.g. truth-values for S, individuals for N), and functors of category $a/bc \ldots n$ are interpreted as functions from the interpretations of $b, c, \ldots, n$ into the interpretation of a. A further development by Montague allows expressions to have both extensions (as above) and intensions (e.g. propositions for S, individual concepts for N) with principles governing the relations between extension and intension. Ontologically, most of these semantic theories carry heavy Platonistic commitments (to sets, functions, possible worlds, or a combination of such entities), at odds with the original ontologically parsimonious intentions of Leśniewski.

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PETER M. SIMONS

Categorial Perception

According to Kant, we humans are capable of sensible intuition only. Non-sensible intuition, which he calls 'intellectual intuition' (*Critique of Pure Reason*, B68, 72 and 159) and which would represent an object immediately, without any appeal to sensibility, would be the sort of intuition to be had by a god. Probably under the influence of Kant and of the dominant positivist and empiricist trend of the last two centuries, there have arisen serious misgivings in epistemology in regard to any sort of non-sensible intuition.

Empiricism seems, however, to have failed to give an adequate account of scientific knowledge both in the natural sciences and in formal disciplines like mathematics. Although in the epistemology of natural science the last word has not been said, it seems clear that theoretical concepts and constructions irreducible to observations play a decisive and pervasive role in the natural-scientific endeavour. In mathematics, the situation is not very different from that in the natural sciences, and empirical accounts of mathematical knowledge are still very rudimentary. On the other hand, the best-known non-empirical (for example Platonist) conceptions of mathematics have not developed an epistemology that could satisfactorily account for our mathematical knowledge. On this point, Edmund Husserl, in the *Logical Investigations* and elsewhere, has developed a conception of knowledge, including mathematical knowledge, in which a sort of non-sensible intuition – which he calls 'categorial intuition' – plays a key role.

According to Husserl, categorial intuition – and, in particular, its most important species, categorial perception – does not have anything mysterious or 'metaphysical' about it, but is founded on sensible intuition. Husserl had distinguished between acts in which meanings are constituted and acts in which

those meanings are fulfilled. Correspondingly, he had distinguished between the meanings of expressions and the objectualities referred to by those expressions by means of their meanings. In the particular case of statements, their meanings are for Husserl *propositions* (or *thoughts*) and their references *states of affairs*. Concerning the fulfilment of the meaning of a statement by an act in which a corresponding state of affairs is given, Husserl observes that the formal constituents of statements – e.g. the word 'is', the grammatical counterparts of the logical connectives (like 'and', 'or', and 'not') and quantifiers (like 'all', 'some', and 'none') and also numerical determinations and relational expressions (like 'greater than' and 'at the side of') – do not have any direct counterpart in sensible perception. Only the material constituents of the statement can have their fulfilment in sensible perception (or in sensible imagination). But although the formal constituents of statements do not obtain their fulfilment from sensible intuition, we do speak of the fulfilment of the meanings of statements in which such formal constituents occur. Nothing in sensible perception corresponds to the 'is' or to the 'and', to the 'or' or to the 'not', to the 'some' or to the 'is greater than'. Moreover, we cannot sensibly imagine, nor paint nor photograph, the intuitive counterparts of those particles. However, if there were no possible fulfilment of the meanings of such formal constituents of statements, we could not clearly differentiate between the fulfilment of the meanings of 'Jack or Bill is in the library' and 'Jack and Bill are in the library', although those two statements clearly have different truth conditions. Hence, although the meanings of formal constituents of statements, like 'and' and 'or', cannot be fulfilled in any sensible intuition, they must be fulfilled somehow, if the meanings of statements – even those most directly bound to perception – are to be fulfilled. The meanings of such formal constituents of statements can be fulfilled in categorial perception.

Moreover, in categorial perception, Husserl claims, not only are the meanings of the formal constituents of statements fulfilled, but new objectualities, e.g. sets, numbers, and states of affairs, are constituted. These categorially formed objectualities are not merely symbolically meant, but actually intuited in categorial perception (or in categorial imagination). Categorial perception is founded on sensible perception, but does not reduce to it, and the objects constituted in categorial perception are founded on the objects given in the founding sensible perception(s), but do not reduce to them. A set is 'built' on the members of the set, but does not reduce to them. It is not only a different entity but an entity of a different sort than its sensibly given elements. A set is a categorial objectuality (or objectuality of the understanding), and can only be given in a categorial intuition, which is always a founded act.

It should be stressed that categorial perception neither modifies nor transforms the sensibly given. It neither glues together nor links sensible objects to produce a new sensible whole. If such were the case, categorial perception would be a falsifying reorganization of the sensibly given, and the result would still be a sensible object, although different from those of the founding acts. What is constituted in categorial perception, although founded on the sensibly given, is a non-sensible objectuality.

Categorial objectualities immediately founded on sensible perception (or on sensible imagination) are objectualities of a higher level than the sensible objectualities on which they are founded. Let us say that sensible objectualities are of zero level, whereas the categorial objectualities that we have been considering are objectualities of the first level. These categorial objectualities of the first level can themselves serve as founding objectualities for categorial objectualities of the second level, constituted in new categorial intuitions. It is a possibility of the understanding to continue in this manner constituting categorial objectualities of ever higher levels founded on categorial objectualities of lower levels, and building an infinite hierarchy of categorial objectualities.

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GUILLERMO E. ROSADO HADDOCK

Categories

Originally, the Greek word corresponding to the English 'category' meant 'predicate' in a wide sense. In modern language-oriented philosophy it often means basic notion or basic concept, whether in a natural language or in a philosophical system. However, in ontology and metaphysics proper the term 'category' has the sense in which it was used by Aristotle and Kant.

Aristotle. It was Aristotle who introduced 'category' as a technical philosophical term. In a short treatise called precisely *Categories*, he lists and discusses ten categories: substance (more precisely: secondary substance), quantity, quality, relation, place, date (or time), posture (or position), state, action, and passivity (or passion). For Aristotle, these genera represent not only basic concepts but an ultimate division of the world (*Met.* Z.1). His views on categories are inseparable from his views on universals.

According to Aristotle, universals exist not only in the mind and/or in language, but also *in re*, i.e. in the world itself. Thus he is an immanent realist. His categories are universals *in re* which satisfy two conditions:

1. they are supposed to be the most abstract universals *in re*, and
2. they are to differentiate the world.

Therefore it is not the case that any 'widest possible predicate' refers to a category. Such a predicate may be a purely nominalist construction or may, like 'being' and 'unity', be applicable to everything in the world.

An Aristotelian category is a highest genus of being.

Kant. The *Critique of Pure Reason* (1st Division, Book I, Chap. I, Section 3) enumerates twelve categories of pure concepts of understanding. Although Kant's list differs from that of Aristotle, he explicitly refers to Aristotle when introducing the term 'categories'. The similarity between Aristotle and Kant, however, is not at first sight obvious. Kant's categories have nothing to do with the things in themselves, i.e. with his so-called noumenal world. The similarity comes out when Kant's phenomenal world is substituted for Aristotle's more commonsensical conception of the world.

The phenomenal world, the world in which we empirical egos live, is constituted by two Forms of Intuition (space and time) and the twelve Categories of Understanding (unity, plurality, totality, reality, negation, limitation, inherence-subsistence, cause-effect, reciprocity, possibility-impossibility, existence-non-existence, necessity-contingency). All of these are rooted in a transcendental ego. The transcendental is fused with sensible matter which in some way is dependent on the noumenal world. The result of this fusion makes up the phenomenal world, which means that the categories do not exist in a pure transcendental realm. They are universals *in re* only in the sense that they exist in the things of the phenomenal world. With regard to this world, however, even Kant is an immanent realist.

Space and time, it should be noted, are not called categories by Kant. Although Kant here differs from Aristotle he is not losing sight of the meaning of a category. According to Kant, space and time are *necessarily singular*; there can be only one space and one time. This being so, space and time are not universals, and so they cannot be categories.

There are in Kant's system predicates which relate to the phenomenal world and which are wider than the categories. For instance, Kant classifies the categories unity, plurality, and totality under the predicate 'quantity'; reality, negation, and limitation under 'quality'; inherence-subsistence, cause-effect, and reciprocity under the predicate 'relation'; and the last three categories under 'modality'. These four predicates have to be interpreted as being universal terms in the nominalist sense. They do not in any

sense refer to universals *in re*. The category terms are the terms which refer to the widest possible universals *in* (phenomenal) *re*.

A Kantian category is a highest genus of phenomenal being.

Deriving Categories. Kant's list of categories is embedded in a thoroughly worked out philosophical system. Kant assumes that by his method of transcendental deduction, he has given an exhaustive enumeration of all the categories which are necessary for phenomenal being. The term 'category' thereby takes on the meaning not only of *highest* genus of being, but also of *necessary* genus of being. Aristotle, on the other hand, presents a mere list of categories (a '*Kategorientafel*'), rather than a theory of categories ('*Kategorienlehre*'), but implicitly even his categories seem to represent a necessary differentiation of the world. This differentiation is not, however, prescribed by a transcendental faculty of understanding but by nature itself.

Aristotle does not regard lower genera as derivable from the higher ones. Subcategories cannot be derived from the categories; their specific content is externally added. Kant, on the other hand, although he does not pursue any derivation in his *Critique of Pure Reason*, says explicitly that subcategories (predicables) may be derived from the categories (predicaments). Force, action, and passion, for instance, may be derived from the category of causality. But such derivations are confined to *a priori* concepts, i.e. universals grounded in the transcendental faculty of understanding. When it comes to universals grounded in sensible matter, their specific universality is regarded as externally added to and not derivable from the categories under which they are subsumed. Kantian categories are regarded as universal forms for sensible contents.

Idealism. Aristotle maintains that there are universals *in re* and Kant that there are universals *in phenomenal re*. Absolute idealists maintain that there are, independently of human minds, universals *in spiritual re*. Are, then, the highest genera of their metaphysical systems to be called categories, too? Many absolute idealists, Hegel in particular, criticize traditional form–content distinctions and hold *all* lower genera of being to be in some sense derivable from the highest one(s). Hegel's *Logik* is from this point of view the deduction of a long chain of categories, subcategories, and sub-subcategories. In Hegelian systems there are no logical gaps between the highest genera and all the other universals. The categories of such systems, therefore, do not have the kind of independence they are afforded in the Aristotelian and Kantian systems.

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INGVAR JOHANSSON

Category Theory

In mathematics, the study of specific problems and systems is supplemented by the consideration of general notions which serve to organize mathematical results and to describe the nature and purpose of mathematics. Thus 19th-century geometry could be organized as the study of different kinds of symmetry and of the group formed by all symmetries of a given kind, as in the so-called 'Erlanger Program' proposed in 1872 by Felix Klein (1849–1925). In the 20th century it became customary to base all mathematics on set theory, and to construct numbers and space from sets, using (say) the Zermelo-Fraenkel axioms. A different and more recent organizational concept is that of '*category*'. Typically, a category will consist of all the mathematical objects of some specified type, together with the maps or 'morphisms' between two such objects. Thus in linear algebra the category VECT of all real vector spaces consists of all such vector spaces U, V, W together with all the linear transformations $L: U \rightarrow V$ from one such space U to a second

such. If $M: V \to W$ is another such linear transformation one constructs the composite transformation $M \circ L: U \to W$ (apply L, then apply M); this is the transformation usually represented by the (matrix) product of the corresponding matrices. In geometry the category TOP of all (topological) spaces X, Y consists of all such spaces, the continuous maps or functions $f: X \to Y$ from one such space to another, and the composites of such maps. The category SET of all sets S, T includes all functions $f: S \to T$ sending one set S into another set T. The apparent paradox involved in considering 'all sets' causes no real trouble.

The formal definition of a category matches these examples. Thus a category C consists of *objects* $A, B, C, \ldots$ and of *arrows* f, g, h. Each arrow has some object A as its *domain* and another B as its codomain; it 'goes' from A to B, as in the usual presentation as $f: A \to B$. A *composite* $g \circ f$ of two arrows is defined only when the domain of g is the codomain of f; in symbols $g: B \to C$. This composite is then an arrow $g \circ f: A \to C$. The axioms for a category then require that this composite is associative, $h \circ (g \circ f) = (h \circ g) \circ f$ whenever possible (that is, when h has domain C), and that to every object B there is an identity arrow $1_B: B \to B$ with the expected composites ($1_B \circ f = f, g \circ 1_B = g$). Thus VECT, TOP, and SET as described above are categories, and there are many such examples (e.g., the category of 'all' groups or of 'all' smooth manifolds). The categorical approach thus emphasizes the sense in which mathematics considers not just structures (the objects) but also maps (arrows) between individual structures. This shifts the previous emphasis from things 'inside' an object (subgroups, elements) to the relations of one object to another. There are also 'smaller' categories: that of all finite sets, or the category with just two objects 1 and 2, two arrows $1 \rightrightarrows 2$ and the two necessary identity arrows.

This definition of a category as an algebraic structure was first formulated in 1945 by S. Eilenberg and S. MacLane, who were led to this notion by problems of algebraic topology, involving the comparison of continuous maps with homomorphisms of groups. They borrowed the term 'category' from the usage in philosophy in order to emphasize its coverage of 'all' things of a given sort. The definition (as given above) is purely axiomatic, so is not based on any prior set theory. Indeed, it is now possible to give additional axioms characterizing the category of all sets; see the article, "Topos Theory" in this Handbook for this basic development, which clearly indicates real alternatives to the usual set-theoretic foundations. One may also describe a category within a given set theory: a category consists of a class of objects A, B, C and a rule assigning to each ordered pair of objects A, B a set $\hom(A, B)$ (namely, the set of all arrows from A to B), together with a suitable composition sending the Cartesian product $\hom(B, C) \times \hom(A, B)$ into $\hom(A, C)$, with associativity and identity as before. Different categories **C** and **D** may be compared by a 'functor' $F: \mathbf{C} \to \mathbf{D}$, which sends each object C of **C** into an object FC of **D** and each arrow f of C into an arrow Ff of **D** so as to preserve domain, codomain, composite, and identities. This notion arose because algebraic topology rests essentially on such functors mapping TOP into VECT, say by homology or homotopy groups; it is essential in the formulation of axiomatic homology. For example, the operation transferring homotopy to homology is *natural* in the following sense: given F and a second functor $G: \mathbf{C} \to \mathbf{D}$, a natural transformation $\theta: F \to G$ assigns to each object C an arrow $\theta C: FC \to GC$ of D in such a way that $(Gf) \circ \theta C = \theta B \circ Ff$ for every arrow $f: C \to B$ of **C**. Despite the apparent foundational difficulties, one often considers CAT, the category of all categories (!) with objects categories, arrows functors, and (in addition) natural transformations as the so-called 2-cells.

Adjunction is the most basic notion. A functor $F: \mathbf{C} \to \mathbf{D}$ has a right adjoint $U: \mathbf{D} \to \mathbf{C}$ (and is then a left adjoint) when there is given a transformation $\theta: \hom(FC, D) \simeq \hom(CV, UD)$ which is one-to-one and natural in each of the arguments C and D. There are many important examples; thus the functor SET $\to$ VECT which sends each set S to the vector space with basis S has a right adjoint (the 'forgetful' functor) which sends each vector space to the set of its elements. An adjunc-

tion θ sends the identity map $FC \to D = FC$ into an arrow $\eta: C \to UFC$ which has an important universal property. With such universal properties one can formulate conceptual descriptions of 'free' objects, of tensor products (of vector spaces), and of Cartesian products (of groups or sets). For example, this approach avoids the usual definition of product via the artificial set-theoretic notion of an ordered pair.

In addition to research on categories, the categorical concepts have been notably useful in various branches of mathematics: algebraic geometry, topology, and in parts of the study of manifolds. The use of categories as an alternative foundation for mathematics is subject to lively and continued controversy. The issue is: what is mathematics really about? About sets or about arrows (functions)?

Set theory proposes a single foundation for all mathematics, while categorical approaches allow separate foundations for separate parts. Thus the natural numbers can be characterized not by the Peano postulates, but by a single universal property. Also many categories are equipped with internal logical operations and hence with an 'internal' logic which may differ from the usual classical 'external' logic. Such categories may also be equipped with a corresponding language and semantics.

Category theory replaces elements of sets by alternative descriptions with arrows. Thus a function $m: A \to S$ from a set A is said to be one-one-into (an 'injection') if $ma = mb$ implies $a = b$ for any two elements a and b of A. Correspondingly, in a category an arrow $m: A \to S$ is a monomorphism if for any two arrows $f, g: B \to A$, $mf = mg$ implies $f = g$. (In the category of sets these two notions happily coincide.) Similarly, in sets the 'pullback' of two arrows $f: A \to B$ and $g: C \to D$ is the set P of all pairs a, c with $fa = gc$ in B. This can be described *without* elements.

In sets every monomorphism $m: A \to S$ has a characteristic function $k: S \to \Omega$ where Ω is the set with two elements 0 and 1 and $ks = 0$ if s is in A, otherwise $ks = 1$. Then A is the pullback of $k: S \to \Omega$ and $\{0\} \to \{0,1\}$. In this case, Ω is two-valued. Such an object Ω, called a subobject classifier, is present in many other categories (e.g., in a topos). It carries the internal logic – which then need not be two-valued. Thus the categorical language allows greater flexibility in forming the 'internal' logic.

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SAUNDERS MAC LANE

Causality

Causality is often the root ontological concept around which a philosophical system is built, and it has been interpreted in two radically different ways which systematically divide these systems. Are efficient causes guided by final causes or is an efficient cause – whether the causal relation be construed as *de facto* or necessary – a basic concept? The historical examples given are meant to illustrate the systematic issues and are infinitely inexhaustive.

Aristotle heads the list of those holding the primacy of final cause. He maintained that a cause has four components: material, efficient, formal, and final. This four-way analysis is at the heart of Aristotle's ontology, implicating, as it does, his distinction between form and matter and his concepts of substance and entelechy. The schoolmen accepted this view of cause, their distinction between *rationes cognoscendi* and *essendi* corresponding to the Master's distinction between knowledge-of-the-fact and knowledge-of-the-reasoned-fact. Unfortunately, this view has difficulty in explaining the prima-facie pointless and irrational features of the world. The first person in this tradition who seriously attempted to account for the

dysteleological features of the world was Leibniz.

For Leibniz what we take to be material causality turns out to be apparent, not real; causality instead is a real teleological impulsion responsible for the sequence of phenomenal representations – all this being, of course, in conformity with the final purpose envisioned by God. To be sure, he wrote, this is not a perfect world; there are all too many dysteleological elements. However, the creation of *any* world would be less than perfect since it is less than God. God's genius lies in having created the best possible world that is commensurate with his creating any world at all. It is in this sense that we have the best of all possible worlds. Unfortunately Leibniz was left with the impossible task of showing that this world would be less good without any of its dysteleological elements. The dysteleological features of the world which were never successfully dealt with in this tradition plus the emergence of modern science – which, while metaphysically neutral, according to Chauncey Wright (1830–75), nevertheless offers nothing but non-teleological explanations – caused a decline in the teleological ontology of causality.

It must not be supposed that final causality has disappeared from the scene; far from it, since it is at the heart of any theism that sincerely offers itself as an ontology as well as a revealed religion. Outside these quarters, however, with one exception, discussion of final causation is muted except when talking about human agency. The exception is the recent manipulability analysis of the concept of cause, notably exemplified in the work of Douglas A. T. Gasking. On this view a causal expression is 'very near' the same as the recipe for producing or preventing certain effects. The business of science, then, is to turn the basic causal 'recipes' into 'inference licenses'. The goal here is not to sustain ontological goals but rather to rid the world of ontological commitments; but few philosophers seem content with saying that a scientific law is a useful expression but not a proposition which, in our world, is true.

The concept of efficient cause considered non-teleologically, it seems fair to say, has been the focus of attention in most of modern and contemporary philosophy. Among those who treat the causal relation, conceived non-teleologically, as a *de facto* relation is David Hume. Hume lends himself to various interpretations, one of which, however, favoured by later positivists, is that cause means constant conjunction. Perhaps a more plausible interpretation of Hume is a sceptical one according to which he does not deny that there is a necessary connection between matters of fact but only sceptically shows that we cannot prove that this is so. However, the Hume that was most relevant to later philosophers is the positivistic Hume. This interpretation, however, a completely *de facto* one, is unable to explain the difference between nomic and accidental universals and the justifiability of counterfactual inference. John Stuart Mill (1806–73) was trying to repair these difficulties when he insisted that constant conjunctions must be 'unconditional' to qualify as causes. But he defined the latter concept wholly untenably as a constant conjunction for which a counterexample is inconceivable. Conceivability, of course, is a function of a given state of knowledge and hence cannot function as a universal criterion.

Innumerable recent philosophers, including Carl Hempel (b. 1905), Ernest Nagel (1901–85), and J. L. Mackie, have suggested ingenious ways of distinguishing between accidental and nomic universals (the latter, say, contain only purely qualitative predicates, are unrestricted in scope, have a scope not closed to further augmentation, and so on) and related ways of justifying counterfactual inference all within an extensional Humean framework; but no one of them has seemed to gain general acceptance. To be sure, W. V. O. Quine in his *The Way of Paradox* (pp. 48–52), points out that counterfactual inference is sustained by scientific theory, which, of course, is true but neglects the fact that the extensional and Humean framework has been abandoned for an intensional framework of scientific meaning.

Kant is not only a good representative of one who holds that the relationship between cause and effect is necessary but he also has influenced recent thinkers who, though getting rid of most of his metaphysical bag-

gage, found an essential insight in his work. Kant argued that causes are necessarily connected with their effects within the realm of phenomena – but only within that realm – because the human mind is constituted in such a fashion as to invariably and irresistibly attribute such relationships to the events that it experiences. We do not know with certainty, of course, just what causes produce what effects, but we *are* certain that events succeed one another with necessity precisely because the person actually constitutes the realm of phenomena, of which these events are a part, in this way. Kant fell into a Laplacean dilemma – since all events are caused no human event is morally responsible in the phenomenal world. In his discussion of practical reason Kant's juggling act to account for free will is far from satisfactory.

Recent necessitarians, or singularists, as they are sometimes called, who include among others Curt John Ducasse, William Kneale, Rom Harré, William Wallace, and Edward H. Madden, while rejecting Kant's categories and phenomenal-noumenal distinction etc., believe that Kant had good reasons for calling any *de facto* approach to efficient causality wholly bankrupt. Several recent necessitarians agree in the following ways. First, they reject Kant's notion that necessary propositions are known only *a priori*. There are numerous possible scientific systems, each one of which exhibits conceptual necessity – or it wouldn't be a system. The scientific problem is to find out which of such necessary systems our world exemplifies. And this is wholly an *a posteriori* enterprise. The fault of the Humean in this context is simply to *assume* erroneously that '*p* is necessary' *and* '*p* is *a priori*', on the one hand, and '*p* is contingent' and '*p* is *a posteriori*', on the other, are materially equivalent. Second, unlike Kant, they avoid the Laplacean paradox. Like Roderick M. Chisholm in another context, they take their cue from Thomas Reid (1710–96) and the Scottish tradition and hold that motives are erroneously conceived as causes. They insist that the concept of causality is inapplicable to human actions, though it is of course applicable to any human behaviour for which there is no apparent point. Hence a human agent causes an act but motives in turn do not cause him to act the way he does and hence the paradox of Pierre Simon de Laplace (1749–1827) is apparently avoided. Much discussion and controversy still swirls about the concept of agent causality.

There is another strand in causal literature wholly in the ateleological fold which, however, yields both *de facto* and necessitarian positions. Causality is sometimes defined as a whole set of necessary conditions sufficient to produce an event just as, say, the dry underbrush, prevailing wind, and some means of ignition is a set of necessary conditions sufficient to produce a forest fire. This causal relation, John Stuart Mill claimed, is wholly *de facto*. One problem with this view is that it is difficult to decide what constitutes a whole set of necessary conditions. Is it necessary to mention the oxygen in the air, the presence of the atmosphere around the earth, the presence of the planet itself, and so on *ad infinitum*?

With the concept of a controlled scientific experiment in mind, Ducasse distinguished between necessary conditions and a sufficient cause. Both the control and experimental groups are equated with conditions necessary for the occurrence of an effect which, however, does not occur. Hence Ducasse refers to the necessary conditions as 'standing conditions' insufficient to produce the effect. The one new condition added to the experimental group immediately produces the effect and hence constitutes the sufficient cause. According to Ducasse, this experimental method of difference constitutes what we *mean* by cause. Cause is the *only* change immediately prior to the occurrence of an event. Unlike Mill's *de facto* analysis, Ducasse's relationship between cause and effect is a necessary one since it follows from a conceptual analysis of the relationship itself. One cannot, however, resist the feeling that Hume and Ducasse commit the same fallacy in a different context. The fallacy is that of confusing the meaning of the concept cause with the empirical way in which we discover causal relations. On the positivistic analysis of Hume he seems to take the method of agreement, a method of discovering causes, and uses that way of discovering

causes as constituting the meaning of cause. Ducasse, on the other hand, takes the method of difference as the fundamental way of discovering causal relationships and uses that method as definitive of the concept of cause itself.

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Causa Sui

The idea of *causa sui*, literally, a cause of itself, occurs in the works of René Descartes (*First Set of Replies to the Meditations*, 1641). But it appears most significantly in the philosophy of Spinoza, who defines it at the beginning of *Ethics* (Definition I, 1677) as "that whose essence involves existence, or that whose nature cannot be conceived as not existing". In a later passage he says that such a thing necessarily exists or "pertains to its nature to exist". Behind the definitional connection between causation and self-existence is Spinoza's monistic rationalism. Since he holds that there can be only one substance, that everything must have an explanation, and that causal explanation is the only kind there is, the one substance must be the explanation of its own existence: *causa sui*.

Spinoza's idea of *causa sui* is a transmutation of two medieval ideas, that of cause and *ens a se*. According to the medieval view, the causal relation (efficient causality) is transitive, asymmetric, and irreflexive. The property of asymmetry is the focal one in this context. If causality is asymmetric, then it follows that it is also irreflexive. And if nothing can be its own cause, then God in particular cannot be his own cause. But why should anyone think that causality is asymmetric, as Thomas Aquinas clearly does (*Sum. Theol.* I, q.2, ad 2)? Intuitively, if x gets z from y, it is because x does not have z and thus y cannot get z from x. For example, if Cain gets existence from Adam, then Adam cannot get existence from Cain, because if Cain had existence to give to Adam, he would not need to get it from Adam.

It is not clear that this medieval view is correct. Two boards leaning against each other seem to cause each other to stand upright. If this is correct, then there seems to be nothing to prevent extending the analogy to mutually existential causes; that is, two objects might eternally cause each other to exist. And from there one might extend the idea to one object eternally causing itself to exist. This is Spinoza's position. In contrast with the medieval view, Spinoza thought that *causa sui* was reflexive; when x is *causa sui*, x causes x. Further, since only one thing is a cause, *causa sui* is symmetric and transitive.

It is important not to confuse *causa sui* with the idea of *ens a se*. Many medieval philosophers, notably Anselm of Canterbury (*c.* 1033–1109) and John Duns Scotus (*c.* 1265–1303), described God as *ens a se*, literally, a being from itself. Medieval thinkers, like all philosophers, tried to push the search for explanation to its limits. Unlike Spinoza, they did not believe that everything could receive a causal explanation. To say that something is *ens a se* is to deny that it depends on anything. Such a being contrasts with *ens ab alio*, a being that comes from another being and hence depends upon it.

Spinoza uses the idea of *causa sui* as a global principle. The one substance is cause of itself and hence the source of all its modes and attributes. Nothing outside of the self-caused substance can explain anything, and there is nothing outside the self-caused substance that requires explanation. Later philosophers used the term in a more local way, and some, like Jean-Paul Sartre, argue that the idea is contradictory.

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Change

To change is to become different, altered, or modified (adapted from *The Random House Dictionary of the English Language*, 1977 ed.).

It certainly seems reasonable to say that an object changes just in case there is a difference between what that object is like at one time and what it is like at another. Thus,

(C) An object, x, changes if and only if
1. there are contrary properties, P and P',
2. there is an object, x,
3. there are distinct times, t and t', and
4. x has P at t and has P' at t'.

This criterion of change has, in one form or another, embodied the idea of change from the very beginnings of Western philosophy; it is strongly suggested in the writings of Plato (e.g., *Phaedo*, c. 71, 103b; *Theaetetus* 181ff.) and in the works of Aristotle (e.g., *Phys.* 188a32f.; *Met.* 1070b10). And it captures the ancient ideas that change involves contraries and that in change there is an underlying substratum that remains the same (persists).

But, despite the obvious initial plausibility of this criterion, it has been a subject of controversy since at least the time of the pre-Socratic philosophers, Parmenides (5th century BC) and Heraclitus (fl. 500 BC). Among the central causes of concern about (C) has been that, while the idea of change seems to be the idea of alteration, (C) seems to allow that things may change without being altered. For, as it stands, (C) places no restrictions concerning which properties the successive havings of which by some object imply that that object has changed.

Consider the property of being in existence for exactly three hours. An object can have that property and then have a contrary property (e.g., the property of being in existence for exactly four hours) just by persisting; and no object changes, it would seem, merely in virtue of the fact that it persists. Some condition must be added to (C) to rule out of consideration those properties the successive havings of which by an object are simply what that object's persisting consists in (though it may be unclear which these properties are and how to formulate such a restriction).

Now, while no object changes merely in virtue of the fact that it persists, it does seem obvious that no object can change unless it persists. For no object can possess contrary properties simultaneously. 'Temporal slice' theorists, however, might maintain that that is not so; such philosophers accept the idea that apparently persisting objects are really sequences of their temporal parts and that no object truly persists (since no such entity, either temporal slice or sequence of slices ever exists wholly at distinct times). Such philosophers must either accept (C) and deny that anything really changes or revise (C) to accommodate their view that nothing truly persists, perhaps as follows: an apparently persisting thing changes if and only if it is a sequence of temporal slices such that at least two slices in that sequence differ in some way in addition to their temporal properties.

However, this proposal is not without difficulties. First, since no one would be inclined to say that anything had changed just because x has F at t and y ($\neq x$) has G (a contrary of F) at t' ($\neq t$), one cannot accept the proposal without the prospect of there being conditions under which a sequence of temporal slices does in fact constitute an entity that we would ordinarily take to be a persisting one. Second, since the temporal slice theorist construes a thing's temporal parts as on a par with its spatial parts, it appears that such a theorist has no grounds for thinking that an apparently persisting thing's being different at different times is any more significant, from the point of view of the idea of change, than its being different in different places.

Another issue arises, if one insists, as (C) does, that an object that changes, say, from being F to being G, must be such that it exists both at a time it has F and a time at which it has G. For then it will follow that no object changes when it comes into or goes out of existence, since no object has (or lacks) properties at times at which it does not exist. And it might be maintained, to the contrary, that there are no greater changes that an object can undergo than that of coming into

being and going out of existence. However, while it may be admitted that (C) is incapable of dealing with creation *ex nihilo* and complete annihilation, when counted as changes that created and annihilated objects undergo, a defender of (C) can maintain that a thing that comes into existence in virtue, say, of assemblage of parts, or goes out of existence by dint of disassemblage of parts, does not itself change, but that its parts do.

The same issue is raised by the phenomenon of *substantial* change, alleged changes that consist in an object's coming to belong to a category or kind different from the category or kind to which it once belonged, where it is the case that if a thing belongs to a given category or kind it does so essentially or necessarily.

Another difficulty for (C), again having the same source as the others, concerns so-called 'Cambridge' or 'relational' change. That things appear to change merely relationally was noted by Plato (see *Theaetetus* 155b11–14) and, in modern times, by J. M. E. McTaggart (thus the term 'Cambridge change'), and by Peter T. Geach; the current revival of interest in the topic is due to Jaegwon Kim. The problem arises in the following way.

Suppose that some object, x, changes during some period of time, t, from being red to being green. It does seem obvious that each object y ($\neq x$) that exists throughout t is such that there is some relation, R, that y bears to x and x alone throughout t. If so, there is a property, Q, the property of being related by R to an entity that is red, that during t y has and then lacks. Thus, y changes; and so, generalizing, if during any period of time any object changes, then every entity existing at that time changes as well. The problem is that the changes in these relational properties (like Q) with respect to which objects change do not seem to be changes that are real alterations. For example, no person seems altered merely by becoming an uncle, that is, merely by being related in a certain way to another person who 'really' changes (i.e., alters) by giving birth; and no object seems to alter merely by bearing some relation to an entity that changes by turning green.

One possible solution to this problem is to insist that when things change relationally (or undergo mere Cambridge change) they really do *ipso facto* change; and thus there is no serious problem in supposing, with (C), that things that change relationally change *simpliciter*. Alternatively, one might insist that the idea of change really is the idea of alteration, and that nothing really changes just by changing relationally; thus some way must be found to distinguish cases in which an object changes relationally from those in which an object alters (or changes really or non-relationally) and restrict application of (C) just to those cases of non-relational change, where an object really is altered by the successive havings of contrary properties. It will be noticed that whether a thing changes relationally is dependent on other things changing non-relationally, in so far as no thing can change relationally unless some other entity changes non-relationally (Socrates, at a time when he has ceased to change in height, cannot become shorter than Theaetetus, unless Theaetetus grows taller); and this dependent character of Cambridge or relational change may be exploited in the following way to distinguish cases in which an object changes relationally from those in which an object changes non-relationally. An object x, in going from having a property F to having a contrary property G, at some interval of time t, changes relationally if and only if in so going x changes according to (C), and that x goes from having F to having G entails that there is an object y (distinct from it and its parts), and properties F' and G', such that y changes at t from having F' to having G'.

Another problem for (C) is raised by motion. For when an object moves it does not seem to be altered; the moved thing seems in a sense to be no different in itself. In addition, it seems to be the case that an object can be said to move only if it either changes its position with respect to other entities or is coincident with different spatial points at different times. All this suggests that we should think that when a thing moves it changes relationally. But surely it is possible for an object to move while no entity whatsoever alters. Motion seems then to be neither a case of alteration nor a case of relational change.

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LAWRENCE BRIAN LOMBARD

Chaos
I: Chaos and Complexity

Chaos is the deterministic production of behaviour that is unpredictable over long times. Although there are a number of ways to express its defining properties, a simple example will serve to introduce the key considerations in deterministic chaos: the breakdown of predictability, observation of a complex process, and the mathematical effort required to forecast. These have their analogues in the dynamical systems theory of chaos, information theory of measurements, and computation theory of modelling.

The weather is often considered a prime example of unpredictable behaviour. In fact, it is quite predictable. Over the period of one minute (say), one can surely predict it. With a glance out of the nearest window to note the sky's disposition, one can immediately report back a forecast. To predict over one hour, one would search to the horizon, noting more of the sky's prevailing condition. Only then, and not without pause to consider how that might change during the hour, would one offer a tentative prediction. If asked to forecast two weeks in advance one would probably not even attempt the task since the necessary amount of information and the time to assimilate it would be overwhelming. Despite the long-term unpredictability, a meteorologist can write down the equations of motion for the forces controlling the weather dynamics in each case. In this sense, the weather's behaviour is symbolically specified in its entirety. How does unpredictability arise in such a situation?

The short answer is that the governing natural laws, even though expressible in a compact symbolic form, can implicitly prescribe arbitrarily complicated behaviour. To the extent that the natural laws are objectively understood, they are written as *equations of motion*. These are a procedure that, given a sufficient measurement of a system's configuration, specifies how to compute future behaviour. Often articulated in the language of differential calculus, the equations of motion codify the interplay of the components of a system's configuration. They are, in fact, incremental rules, i.e. an *algorithm*, that determine the configuration at the next moment in terms of the one immediately preceding. Forecasting, though, requires knowing the behaviour for any future time.

The belief that this could be done and the assumption that it was easy to do so was most succinctly expressed by Pierre Simon de Laplace (1749–1827) more than two centuries ago:

> The present state of the system of nature is evidently a consequence of what it was in the preceding moment, and if we conceive of an intelligence which at a given instant comprehends all the relations of the entities of the universe, it could state the respective positions, motions, and general affects of all these entities at any time in the past or future.

While Sir Isaac Newton's and Leibniz's invention of the differential calculus gave a new language with which to model natural phenomena, its direct implementation as a procedural description, however, has only recently become feasible. Before this time, when sequential, compounded computation could only be performed by hand, even the simplest prediction problems demanded arduous and typically impractical effort. Thus, mathematical techniques were developed to *invert* the equations of motion. In the limited settings for which this could be carried out, viz. *linear* equations, the analytic

methods yielded *closed-form solutions* which short-cut the direct incremental computation of future behaviour. The main characteristic of linear equations is that given two solutions a third may be found as their sum.

A vast array of phenomena do not share this property. Despite this limitation, closed-form solution has been the dominant criterion for understanding dynamical behaviour since the time of Newton. Its range of applicability has ceased increasing. The types of phenomena now demanding scientific attention, such as the weather and even substantially smaller systems, are explicitly *non-linear* and do not, even in principle, allow for closed-form solution. That there was a fundamental limit to finding closed-form solutions was appreciated by Jules Henri Poincaré (1854–1912) at the turn of this century. Although he despaired of this, he was also the initiator of the alternative approach to describing complex behaviour, *qualitative dynamics*, which later became *dynamical systems theory*.

Dynamical Systems Theory. A central abstraction in dynamical systems theory is that the instantaneous configuration of a process is represented as a point, or *state*, in a space of states. The *dimension* of the state space is the number of numbers required to specify uniquely the system's configuration at each instant. With this, the temporal evolution of the process becomes the motion from state to state along an *orbit* or *trajectory* in the state space.

For a simple clock pendulum the state space is the two-dimensional plane. A state here consists of two numbers: one denoting the position, the other the velocity. The state space of a fluid in a closed box is the collection of all velocity fields: the space of all possible instantaneous changes in fluid particle positions. If every particle moves independently, the dimension of the equivalent dynamical system is exceedingly large: proportional to the number of particles. Despite the difficulty in picturing this representation directly, the temporal evolution of the fluid is abstractly associated with a trajectory in this high-dimensional state space. In the fortunate case when there is strong coherence between components of a large system or when the system itself has only a few significant components, the trajectory can be visualized in a much lower dimensional space.

If a temporal sequence of configurations is observed to be stable under perturbations and is approximately recurrent, then the trajectory is said to lie on an *attractor* in the state space. The attractor concept is a generalization of the classical notion of equilibrium. One of the main contributions of (dissipative) dynamical systems theory is the categorization of all long-term behaviour into three attractor classes. A *fixed point* attractor is a single, isolated state toward which all neighbouring states evolve. A *limit cycle* is a sequence of states that are repetitively visited. These attractors describe predictable behaviour: two orbits starting from nearby states on such an attractor stay close as they evolve. Unpredictable behaviour, for which the latter property is not true, is described by *chaotic attractors*. In a crude approximation, these are often defined negatively as attractors that are neither fixed points, limit cycles, nor products of limit cycles.

There are several complementary descriptions of the basic properties of chaotic attractors. Analytically, they consist of highly convoluted orbits. An infinite number of unstable limit cycles and an infinite number of aperiodic orbits can be embedded in a chaotic attractor. Topologically, chaotic attractors often display self-similar, or *fractal*, structure. Geometrically, although globally stable to perturbations off the attractor, they exhibit average local instability. Orbits starting at close initial states on a chaotic attractor separate exponentially fast. Physically, this local instability amplifies microscopic fluctuations to affect macroscopic scales. Although the resulting macroscopic behaviour may be predictable over sufficiently short times, to an observer it is unpredictable over long times. Even in the absence of microscopic fluctuations, forecasting typical chaotic orbits requires maximal computational effort on the part of an observer who knows the governing equations of motion. The size of the minimal computer program to predict grows with the length of the forecast.

Aside from attractor classification, another significant contribution of dynamical systems

theory is a geometric picture of *transients*: how states off an attractor relax on to it. An attractor's *basin of attraction* is the set of all initial states that evolve on to it. There can be multiple basins, so that radically different behaviour may be seen depending on the initial configuration. The complete catalogue of attractors and their basins for a given dynamical system is called its *attractor-basin portrait*.

Dynamical systems theory is also the study of how attractors and basin structures change with the variation of external control parameters. A *bifurcation* occurs if, with the smooth variation of a control, the attractor-basin portrait changes qualitatively.

Sources of Randomness. To summarize, dynamical systems theory has identified three sources of unpredictability or effective randomness.

1. *Sensitive dependence on initial condition*: To which attractor does the system go? The borders between basins can be highly convoluted, so that completely different attractors can be seen with very small changes in initial condition.
2. *Deterministic chaos*: This is unpredictability of long-term behaviour due to local instability on the attractor.
3. *Sensitive dependence on control parameter*: The attractor-basin portrait can be arbitrarily sensitive to changes in control parameters.

Poincaré expressed an appreciation that such sensitivities could arise in systems governed by known laws as follows:

> But even if it were the case that the natural laws had no longer any secret for us, we could still only know the initial situation *approximately*. If that enabled us to predict the succeeding situation with the *same approximation*, that is all we require, and we should say that the phenomenon had been predicted, that it is governed by laws. But it is not always so; it may happen that small differences in the initial conditions produce very great ones in the final phenomena. A small error in the former will produce an enormous error in the latter. Prediction becomes impossible, and we have the fortuitous phenomenon.

The remark closes with an implicit operational definition of randomness as a phenomenon which appears fortuitous due to ignorance. This and similar notions of uncertainty play an important role in probabilistic descriptions of unpredictable behaviour.

In chaotic systems uncertainty and approximation are rapidly amplified. This precludes not only the long-term prediction of their behaviour, but also the closed-form solution of their equations of motion. Reminiscent of quantum theory, the first difficulty necessitates, even in the classical setting of dynamical systems, a complete accounting of the measurement process. The second requires a computational theory of inferring models from measurements.

Information and Measurement. An observation of a natural process entails measurement of its state. The act of measurement is a codification of the physical configuration. But how much do observations tell one about the process? Information theory measures the amount of information in an observation as the negative logarithm of its probability. Information itself is never rigorously defined; it is only quantified. The most concise attempt, however, is due to G. Bateson (1904–84): information is a difference that makes a difference. This expresses the origin of information in the unanticipation of an event and also its essential relativity.

The average information contained in isolated measurements is called the *dimension* of the underlying process: the minimum amount of information necessary to uniquely identify a configuration. In a complementary way the *dynamical entropy* quantifies how much can be predicted about the next measurement given that one knows the entire history up to that point. It measures the average temporal rate of information loss once a measurement is made. If a process is chaotic a new measurement must be made after a short time since the information about its previous state is lost. From the observer's viewpoint, the dynamical entropy is the rate at which a process produces new information.

Information theory does not give a direct indication of a process's underlying geometric structure, since it is a probabilistic description of the behaviour. The geometry of the underlying attractor can be recovered.

however, even from a single component time series produced by a multidimensional process. Reconstruction methods produce an equivalent state space representation from a time series of observations. They provide a direct connection between experimental data and the geometric tools of dynamical systems theory.

Complexity and Modelling. The minimal computations required to forecast and to model observed behaviour are two measures of its complexity. They are especially important for deterministic chaos. Since there are no closed-form solutions for chaotic orbits, there are no algorithmic short-cuts enabling one to avoid direct incremental computation of future states from the equations of motion. Laplace parenthetically acknowledged the importance of computation complexity for exact prediction:

> But ignorance of the different causes involved in the production of events, as well as their complexity, taken together with the imperfection of analysis, prevents our reaching the same certainty about the vast majority of phenomena.

The complexity associated with forecasting dynamical systems, introduced by G. Chaitin (b. 1947) and A. N. Kolmogorov (1903–87) as a computational measure of randomness, is equivalent to the dynamical entropy. A repetitive process is easy to predict, since there are only a few measurement sequences to anticipate. An ideal random process is difficult to predict due to the diversity of sequences. The repetitive process produces little or no information; the random process produces a maximal amount.

The complexity of modelling, however, is complementary to such 'randomness' measures. The model of the repetitive process is simple: listing the basic pattern again and again is all that is required. The random process is also quite simple, but from a statistical viewpoint. For a random process, one's model is simply to guess at successive measurements. Both repetitive and random processes have low modelling complexity. A complex process is an amalgam of both deterministic and random computations.

Modelling complexity is maximized in processes that are at the border between order and chaos. This is a concise summary of the information-processing capabilities of dynamical systems. It is particularly germane to processes at phase transitions, such as the transition between ice (order) and water (chaos). For adaptive and evolving systems, such as found in biology, the notion of modelling complexity captures the necessary interplay between innovation and utility of function. Innovation allows an organism to adapt to a changing environment. Ordered behaviour and structure are necessary as a foundation for further evolution and in order to take advantage of regularity.

Methodology. Deterministic chaos has found its particular niche in the taxonomy of complex dynamical behaviour. Indeed, research has advanced to an 'engineering' phase in which chaos is designed to control, eliminate, or enhance unpredictability.

Deterministic chaos forced a change in scientific methodology away from the emphasis on closed-form representations for single orbits. One result is that the Baconian notion of inexorable progress in the refinement of scientific theories via experimentation is not strictly valid, since a model prediction will eventually differ from observed behaviour. The error in this prediction can be as large as the attractor itself. The refinement of a 'theory' for a single chaotic orbit cannot be improved beyond that irreducible and large error. One response is to use probabilistic descriptions of the apparent random behaviour. This ignores the tremendous structure in deterministic behaviour, such as the short-term predictability and the shape of a chaotic attractor. Qualitative dynamics is a geometric approach intermediate between exact solution and probabilistic methods.

Chaos, though, is only a shadow of forms of complicated behaviour still to be perceived. What will last, then, is not so much the phenomenon of deterministic chaos, but rather the methodology, *experimental mathematics*, that has been developed to explore it. The goal there is to circumvent the analytical and expressive deficiencies of closed-form solutions in order to directly explore the complexity of analytic models. Digital computers have facilitated much of its development by providing access to vast amounts of

numerical computation. The basic methodology draws on the geometric representations from dynamical systems theory, the quantitative probabilistic descriptions of information theory, and the structural analysis of complexity developed in computation theory.

Name, Number, State. The primary concept on which dynamical systems theory and its applications rest is the notion of *state*. From a scientific-historical perspective, the very recent use of the state concept is seen as only the most recent example of a series of improved descriptive abstractions. These are modes of symbolic representation that facilitate modelling the perceived world. The first in the series might be taken to be the development of language, or more basically, the naming of objects in the perceptual environment. The second was the number concept which gave a refined precision in differentiating named objects.

In the development of descriptive abstractions, new modes do not replace existing ones, but instead are built out of them in a procedural hierarchy: number is an ordering property of sets of named objects. Each mode sets the substrate for a level of modelling and so the complexity at that level depends on that of the lower levels. Although number is an essential aspect of the measurement process, the state abstraction builds on it and introduces a *geometrization* of procedure. Through it time and, especially, the evolution of behaviour become objects for description.

Philosophy of Chaos. The discovery of deterministic chaos and the success of dynamical systems theory belie a reinvigoration of mechanism. Unlike the determinant and lifeless mechanism of a century ago, mechanical systems are now seen as sources of effective randomness, surprise, and innovation. At one and the same time subjectivity enters in an essential way into descriptions of complex behaviour.

The detailed structural theory of chaos and the vast array of non-linear systems exhibiting it make it clear that *randomness* is an ideal only approximable by physical processes. It is characteristic of scientific progress that original concepts give way to a refined understanding. Major advancements in scientific knowledge often exact a toll in discovery of new limitations of the explanatory reach of the existing world view. With the development of geometric descriptions of complexity, there comes the appreciation of the fundamental limits on their predictability.

Many problems in dynamical systems theory derive from the essential tension between local determinism and global indeterminism. The equations of motion specify local space-time rules and so determine the evolution from an initial state entirely. Nonetheless, the long-term and large-scale structures responsible for the observed properties cannot be directly inferred from them. When observed with any finite accuracy, chaotic processes exhibit a preferred direction of time, even though the microscopic equations do not. Via local instability, microscopic determinism leads to macroscopic irreversibility.

The behaviour of non-linear systems cannot be understood solely in terms of their constituents' behaviour. Indeed, it is the very interaction of the constituents that produces complex behaviour. The reductionist methodology fails entirely to capture the structures that arise specifically due to interaction.

From the mechanistic viewpoint, the physical brain is the substrate supporting the mind. There is now the stronger dynamic interpretation: the mind is the dynamics of the brain. Chaos sheds no light on the literal interpretation of the problem of a mind expressing free will. The classical universe described by dynamical systems theory is deterministic. The existence of deterministic chaos does, however, expand the discussion of free will to include the notion of stability of the physical substrate. A system can appear to have *effective free will* in the sense that no one, especially not the system itself, can decide whether its macroscopic behaviour is completely determined, let alone fully predict it. If deterministic chaos were found via experimental investigation to be an essential and common behavioural mode of the physical brain, then one could reasonably conclude that individuals express effective free will.

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Chaos II: Fractals and Chaos

Fractals are geometrical objects with structure at arbitrarily small scales. Chaos is the state a physical system approaches when its initial state gives no information about its subsequent behaviour. Both have been intensively studied recently by mathematicians and physical scientists, as a result of two basic discoveries: that fractals can be described as coherently as any other shapes, and that a deterministic system may yet be chaotic.

Fractals have their origins in the 'pathological' objects that Georg Cantor and Guiseppe Peano (1858–1932), among others, discovered in the late 19th century as counter-examples to too naïvely intuitive ideas about continuity and differentiability (see Stewart 1987). But it was not until the 1970s that thinkers such as B. Mandelbrot argued persuasively that many physical objects are best represented as having such shapes. The crucial idea is the relativity of the dimensions of the object to the scale at which it is considered. The circumference of an island, for example, or the volume of a cloud, will take on different values depending on the measuring unit employed. (A kilometre-long measuring rod would give one answer, a metre-rod another, a millimetre-rod another.) If the object is fractal, the sequence of measurements at different scales does not converge to any determinate number. The dimensions are inherently relative to the scale of measurement. That is not to say that a fractal object does not have objective spatial properties: in fact it is an objective fact which points of space it occupies and which it does not, but these facts do not translate into lengths and volumes.

The spatial characteristics of a fractal are better represented by its fractal dimension (see Falconer 1984). This is most easily explained for self-similar fractals: those which exhibit the same shapes at all scales. (If you take a suitable section of such a fractal and 'magnify' it you find that it is geometrically similar to the whole fractal.) Compare such an object to a cube. A cube is a three-dimensional object in that if you put eight (i.e. two to the power of three) cubes together you get another cube. (And a square is two-dimensional in that if you put four, two to the power two, squares together you get another square.) The dimension of an object will be an integer, on this definition, as long as the number of copies needed to make a similar object is a power of two. But with a self-similar fractal the number of copies required may be any integer at all. So if, for example, three copies of a fractal will reproduce its shape, its dimension is that number d for which 2 to the power d equals three, i.e. 1.4427... A slight generalization gives a dimension to every self-similar fractal. For a non-self-similar fractal one can define the dimension as the number d such that when the object is measured in integral units of length m the length is proportional to e (Euler's constant) to the power $1\text{-}d$. (When both definitions apply they give the same values.)

Fractals occur in the physical world. Measurement of islands, clouds, and plants tends to confirm their fractal nature, and it has been suggested that the physics of such different things as Saturn's rings and the weather patterns produced by a nuclear war require one to consider fractally shaped objects and fractal distributions of matter. And fractals occur in the ubiquitous phenomenon of chaos, as explained below. Objects may thus occupy space in a manner unimagined in the traditional scientific and philosophical

conception of the world. (Perhaps Leibniz would have found fractals congenial. They fit the principle of plenitude, and a single fractal can mirror infinitely many other objects.)

Chaos. Chaos is also a late 19th-century idea whose fundamental importance has only recently been recognized. James Clerk Maxwell (1831–79) was aware in the 1870s that the evolution of a strictly deterministic physical system could be essentially unpredictable. For its later states could depend so sensitively on its initial states that an infinitesimal error in the initial conditions might result in a very large error in later states. And Jules Henri Poincaré (1854–1912) was aware around the turn of the century that for many systems of differential equations the best we can get are 'qualitative' solutions: exact prediction of later states from initial and boundary conditions is not possible. Let us call a physical system chaotic when its evolution takes geometrically simple sets of initial states (geometrically simple regions of phase space) to geometrically complex states, in such a way that information about the initial state is systematically lost. This is not a precise definition, and in fact there is no single precise definition current in physics (see Hunt 1987).

The recent interest in chaos derives from two discoveries. The first discovery is of its ubiquity. The world is full of systems which are in principle unpredictable. A simple pendulum swinging from a very slightly oscillated support shows chaotic motion, as do nearly all real fluid flows. The motion of colliding billiard balls, paradigms of Laplacian determinism, is chaotic given a very small gravitational influence from beyond the billiard table. The second discovery is of mathematical, particularly topological, techniques for classifying and understanding the behaviour of chaotic systems. As a result there is now a lot more to do with an unpredictable system than bewail its unpredictability.

The main conceptual tool for understanding chaotic systems is that of an attractor. An attractor is a set of states (a region of phase space) into which all states in some other set – the attractor's basin of attraction – will evolve. We can often determine what the attractors of a chaotic system are and what their basins of attraction are, even though we can tell with certainty neither whether a particular system will evolve towards a given attractor nor, if it does, what path to it will be taken. The standard technique is to consider a family of systems indexed by one or more parameters, such that for small values of the parameters the system has a small number of attractors, which split into more as the parameter is increased. For some values of the parameters the attractors may fuse into a continuous range. That is a very deep kind of chaos, but the 'route' to it, the ways in which a finite number of attractors bifurcate and eventually fuse, can be systematically studied, and some universal patterns emerge (see Crutchfield *et al.* 1986 and Schuster 1984). The universal patterns are a kind of metaphysics. Call it *chaology*. Chaology is a part of qualitative mechanics, of which the most important other part is catastrophe theory. It brings physical systems of very disparate kinds under the same descriptions at a very high level of abstraction, and in so doing gives us some understanding of how they work.

Fractals and chaos come together at this point. The attractors of a system which is chaotic in the way just described are fractals, as are the boundaries between their basins of attraction. (And an extreme form of chaos will occur when points in a geometrically simple region of phase space are taken to points in a region that approximate a fractal more and more closely as time goes on.)

Fractals raise important questions about the relation between material objects and the space they occupy. And they demonstrate the important point that features of real objects which are too grainy (unplatonic, sublunary) to be captured by a given mathematical idealization may be best represented by imposing more rather than less mathematical structure. Chaotic systems show the hidden false assumptions behind the threat of Laplacian determinism, for example the assumption that if initial conditions determine subsequent states then enough calculation will deduce the subsequent states from the earlier ones.

Moreover, in both areas important issues of definition arise, of a kind that should repay

philosophical attention. For neither fractal dimension nor self-similarity completely captures the concept of a fractal, and there are really a number of different attributes of dynamical systems gathered together under the label of chaos. So some essentially philosophical questions are very much in the air. Which concepts best capture the intuitive geometrical sense of a fractal? Which concepts of a fractal are best suited for describing the important attributes of physical systems, and which ones clarify philosophically and physically important issues about space? And, similarly, we may ask which concepts best describe the philosophically and physically important contrasts between chaotic systems and those for which determinism entails some sort of predictability. None of these questions will yield to philosophical techniques alone. But they are questions that philosophers should be involved with: they ask us to combine careful distinction-making with a sense of the wider issues, and they concern one of the conceptual adventures of our time.

The greatest philosophical opportunity raised by chaos, though, is that of rethinking our understanding of scientific explanation and scientific understanding. Chaology can give us an understanding of the behaviour of physical systems which cannot be got by deducing their states from the laws governing them in accordance with the standard paradigm of explanation. What sort of understanding does this give? Does it show that there are patterns of scientific explanation which elude that standard paradigm, or that such explanation is not properly scientific?

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ADAM MORTON

Chemistry

The ontology of chemistry is concerned with the (*a posteriori*) nature of chemical substances, such as gold and vitamin C, and it investigates the status and relationship of concepts such as pure substance (also called chemical compound, chemical species, chemical kind), molecule (often considered the microscopic essence of a pure substance), atom (building block of a molecule; also called chemical element), and of associated concepts such as valence (the measure of affinity between atoms and similar microconstituents of a substance), structure (in the sense of spatial distribution of affinities between microconstituents), and phase (the state of aggregation of a substance such as solid, liquid, vapour). Although it is generally assumed that a *pure substance* is defined in terms of (atomic) composition and (molecular) structure, a strictly macroscopic definition is also possible: a pure substance is a phase of which macroproperties such as density and electric conductivity do not change during a phase conversion (as in boiling a liquid or melting a solid phase).

Robert Boyle (1627–91) and John Dalton (1766–1844) tailored atomism to the needs of chemistry. However, the phrase 'ontology of chemistry' is not often encountered and the philosophy of chemistry is virtually nonexistent (for a bibliography see van Brakel and Vermeeren 1981). Since Thomas Kuhn (b. 1922) referred to the revolution brought about by Joseph Priestley (1733–1804) and Antoine-Laurent Lavoisier (1743–94), removing phlogiston from the language of chemistry, philosophical reflection on the history of chemistry has increased, but the attention given to chemistry in the philosophy of science is still limited and discussions of, for example, scientific atomism tend to concentrate on the physical side of the issue.

According to Dalton there exist "simple elementary particles" (atoms), which may combine into "compound particles" (mo-

lecules). Dalton followed the Democritean tradition but he stressed that there are a number of distinct atom types, whose instances differ in size, weight, and mutual attraction (affinity). It is basically this atomic paradigm that found its way into most chemistry textbooks. Since Dalton, however, it has been established that chemical elements as ordered in the Periodic Table are not simple. Rather, they have a complex internal structure and one element in the taxonomy covers a number of isotopes having different macroproperties. Furthermore, atoms can disintegrate and fuse.

In addition, there has been a change from defining a pure substance in terms only of composition, to the situation where structure is considered a more fundamental property. Moreover, the idea of structure as a static architectonics of atoms and bonds has turned out to be no more than a convenient selective idealization of more fluid relationships. This idea was already undermined during the development of the theory about resonance structures between 1872 (Friedrich Kekulé, 1829–96) and 1931 (Linus Pauling, b. 1901). In a benzene molecule, for example, it is not possible to specify exactly where there are single and double bonds. The real situation is a kind of mixture of a number of possible fixed arrangements of nuclei (of atoms) and electrons. The subsequent development of quantum mechanical accounts of the organization of electrons in a molecule has further undermined the architectonic concepts of atom and molecule, to the extent that we now find scientific articles with titles such as "Must the molecule have a shape?". Hence there is modern support for the views of Ernst Mach and Friedrich Wilhelm Ostwald (1853–1932), who, at the beginning of this century, opposed the reality of atoms as material objects: either we have to discard any kind of micro entity realism altogether (Mach's view), or energy has to replace matter as the basis of the ontology of substances (the view of Ostwald).

The change in emphasis from (macroscopic) composition to (submicroscopic) structure also undermined the essentialistic idea that what remains the same under the changing appearances of chemical substances are the complex but identical molecules. First, large molecules (enzymes, viruses) are only approximately the same, even at the level of composition. Second, and more crucially, the microstructure is as much dependent on circumstances as are the macroproperties. For example, liquid water does not simply consist of H_2O molecules, but contains various entities a little smaller or larger than H_2O molecules (for example OH-ions and H_4O_2 molecules), and how much there is of each depends on the temperature and other parameters. If essences are as much dependent on context as macroproperties, then this gives little scientific support for the recent views of Saul Kripke and Hilary Putnam on natural kinds.

Through all these changes there has been the constant question whether it is correct to separate the ontology of chemistry from that of physics. One possibility is to consider the following two separate issues: first, the ontology of *matter in general*, to be dealt with in relation to developments in microphysics and astrophysics; second, the ontology of *particular kinds of matter*, i.e. chemical kinds. There are good grounds for this distinction because, as noted above, chemical kinds can be defined in terms of macroscopic properties alone. This would lead us back to the view of Lavoisier that chemistry is the quantitative science of the macroproperties of substances and their transformations.

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JAAP VAN BRAKEL

Chisholm, Roderick M.

Roderick M. Chisholm was born in North Attleboro, Massachusetts, in 1916, and studied at Brown (BA, 1938), and Harvard (Ph.D., 1942). Throughout a long and productive career Chisholm has opposed various

influential forms of reductionism. Here are some examples:

1. Phenomenalism, the reduction of physical objects to sense-data or to sensory experience. See his "The problem of empiricism" (*Journal of Philosophy*, 1948) and the Appendix to his book *Perceiving* (1957).
2. Extensionalism, the reduction of the intensional to the extensional. See his "The contrary to fact conditional" (*Mind*, 945) and "Sentences about believing" (*Proceedings of the Aristotelian Society*, 1956).
3. Physicalism, the reduction of the mental, including the intentional, to the physical, partly by way of the linguistic. See again his "Sentences about believing" and also the "Chisholm-Sellars correspondence on intentionality" (*Minnesota Studies in the Philosophy of Science*, 1957).

While opposing these powerful contemporary forces early and long, Chisholm has developed an original philosophy whose intricacy of elaboration stands in pleasing contrast to the great simplicity of its ontological and conceptual basis. The style of its presentation is, moreover, distinctively simple and direct. The resulting insights are systematically interrelated in a body of works that cannot be appreciated properly except when taken as a whole.

The Adverbial Theory of Sensory Experience. This view rejects act-object analyses of experience, and hence rejects sense-data. Here Chisholm develops in his own way an approach first presented by C. J. Ducasse in a contribution to *The Philosophy of G. E. Moore*. According to the adverbial theory, even though our grammar is often suggestive of an act-object analysis of experience – as in 'I see stars' or 'I hear a ringing (in my ears)' – this suggestion is as misleading as is the corresponding suggestion conveyed by 'We danced a waltz'. The underlying realities are, respectively, our dancing somehow, in some specific way (waltzily), and our seeing or hearing in certain ways.

Agent Causation and Libertarianism. Chisholm summarizes the metaphysical problem of human freedom as follows: although people are responsible for some of their actions, this seems incompatible both with determinism and with indeterminism. A distinctive solution is then advanced in opposition to the compatibilist mainstream, a solution that accepts indeterminism but requires a distinctive form of causation; not the 'transeunt' causation proper to events, but 'immanent' causation by an agent.

The Primacy of the Intentional. Chisholm joins Leibniz and Franz Brentano in holding that "reflection on the self and on what it is to think provides us with the key to understanding the fundamental categories of reality". Very early he subscribes to the primacy of the intentional, to the view that the reference of language is to be explicated by the intentionality of thought and not conversely. Starting with a powerful statement in "Sentences about believing" and in the "Chisholm-Sellars correspondence", Chisholm has repeatedly returned to this deepest of questions, developing a systematic defence of his position. The latest important development is the category of *de re* thought, which has prompted extensive and important revisions of earlier views. For the earlier views see *Person and Object* (1976); for the later *The First Person* (1981).

From the beginning Chisholm has drawn variously and deeply on insights in Austrian philosophical traditions, and especially on those of Brentano, whose prominence in Anglo-American analytic philosophy is mainly due to Chisholm.

Ontology Intentionally Understood. Chisholm's interest in categorial ontology intensified in the 1960s and bears fruit in a system that aims for the highest conceptual and ontological economy even at the cost of considerable definitional intricacy:

> Among the principal desiderata in . . . setting forth a theory of categories are (1) economy with respect to the types of entity which are countenanced and (2) simplicity with respect to the types of concept which are used (*On Metaphysics*, 1989, p. 163).

The system is presented in a tensed language that makes use of fundamental concepts of exemplification, necessity, attribution, being-a-state-of, and being-a-constituent-of.

Properties or attributes are then introduced on this basis, a notion of entailment is defined by appeal to attribution and necessity, and this intentional notion is used to define the structure of properties and to provide a criterion of identity for properties.

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ERNEST SOSA

Chrysippus

Chrysippus, the third head of the Stoic School (from 232 BC to his death in 208 BC), was born in Cilicia in about 280 BC. He consolidated Stoic doctrines as formulated by the first two heads, Zeno and Cleanthes, and made several original contributions. He was proclaimed in antiquity as the second founder of the Stoa, undoubtedly because he so ably defended the Stoa against powerful attacks by the Sceptics. Chrysippus's strength in argumentation was notoriously formidable. It was said of him, "If there were dialectic among the gods, it would be none other than that of Chrysippus". His contributions to each of the three departments of Stoic philosophy – logic, physics, and ethics – were substantial and his influence on the school in the several subsequent centuries of its life was immense. Epictetus, in the second century AD, chided his students for preening their feathers over having mastered the books of Chrysippus. And it was said of him, "Had there been no Chrysippus, there would have been no Stoa".

In logic Chrysippus is best known for the impetus he gave to the development of propositional logic from Megarian foundations. This logic, unlike that of Aristotle, for which terms or classes are the structural units of argument, has as its elements atomic propositions. From these are formed compound propositions – conjunctions, disjunctions, causal propositions, 'more likely than' propositions, and conditionals. Chrysippus evinced a particular interest in the conditional proposition, arguments constructed on it, and the criteria for its truth. He maintained that a conditional is true if the truth of its antecedent is incompatible with the falsity of its consequent. Chrysippus, however, envisions the incompatibility as empirical rather than logical. Certain argument forms – for example, if the first, then the second; but the first, so the second – are taken as axiomatic. One then shows the validity of arguments by demonstrating them to be instantiations of these forms or of forms derivable from them. Stoic logic included, besides a study of argumentation and validity, epistemology, semantics, grammar, and syntax. Chrysippus was a representationalist and so of course a realist as regards the external world.

According to Chrysippus's materialist physics the basic entities from which the universe is formed are, on the one hand, a formative power, called variously God, λόγος, or πνεῦμα, and, on the other, matter. This immanent force is cohesiveness in inorganic physical bodies, life in organic bodies, and reason in the human animal. The principle of causality is universally operative. Periodically fire consumes the universe, the exact history of which recurs. Chrysippus rejects Plato's tripartite soul for a soul which is all reason, a fragment of the λόγος or reason of the universe. As Chrysippus rightly sees, this psychology dictates an intellectualistic interpretation of the passions, in accordance with which a passion is a recently formed judgement. Accordingly, therapy for the passions involves their total extinction via the realization that the judgements constituting them are false. Clearly, then, reason rules in the universe and it manifests itself in the human being as a kind of navigator through the shoals of life.

For Chrysippus, like all Greeks a eudaemonist, happiness consists in living in accordance with one's experience of things which occur naturally. The views of the many notwithstanding, the only good thing is a cognitive state of mind, i.e., the knowledge that the morally good is the only good thing there is. Chrysippus accepted the determin-

ism involved in the principle of causality and then sought to blunt the criticisms emanating from rival schools of philosophy by arguing that since the human being's reason is a fragment of the universal λόγος, its decisions, while not free, are not arbitrary either. On the other hand, Chrysippus assumes, inconsistently I fear, that the human being is responsible, for example, for the destructive passions suffered by its soul. Chrysippus emphasizes not only the identity of reason in each soul with the reason of the cosmos but also the individuality of each thing in the universe. Eternal life is denied to the individual human being but each person will replay the same role in another of the cycles of the universe.

The philosophy of Chrysippus, a comprehensive doctrine of the universe and of the theoretical and practical activity of the human beings in it, constituted an impressive edifice of thought in antiquity. Even through the fragmentary remains of Chrysippus's writings one can glimpse a serious, profound, and aggressive thinker who made admired and admirable contributions to logic, natural philosophy, and ethics.

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JOSIAH B. GOULD

Church, Alonzo

Alonzo Church (b. 1903), American logician, has made a number of important contributions to mathematical logic but is best known for his proof of Church's Theorem, that there exists no effective procedure for deciding the validity of an arbitrary formula of first-order logic. His main contributions to ontology are his clarification and defence of realism in mathematics and in logic, and his work on the theory of abstract concepts in connection with formalizations of intensional logic.

Church's methodology might be characterized as 'hypothetico-deductive *a priori*'. He urges that alternative approaches to semantics and logic be precisely formulated and then tested, in terms of their consequences, against the 'data'. In 1951b he formulated a theory of meaning, based on the ideas of Gottlob Frege, which employs abstract entities of various kinds, propositions and (non-psychological) concepts. He demands of such a theory that:

> it have a place for all observably informative kinds of communication – including such notoriously troublesome cases as belief statements, modal statements, conditions contrary to fact – or at least that it provide a (theoretically) workable substitute for them. And solutions must be available for puzzles about meaning which may arise, such as the so-called paradox of analysis (p. 101).

Church even maintains that there is a kind of observation of propositions and other meanings:

> the preference of (say) *seeing* over *understanding* as a method of observation seems to me capricious. For just as an opaque body may be seen, so a concept may be understood or grasped. And the parallel between the two cases is indeed rather close. In both cases the observation is not direct but through intermediaries – light, lens of eye or optical instrument, and retina in the case of visible body, linguistic expressions in the case of the concept (p. 104).

In another article Church describes logic as "a theory of deductive reasoning, plus whatever is required in object language or metalanguage for the adequacy, generality, and simplicity of the theory" (1962, p. 181). He goes on to urge that such a theory seems to require quantification over various abstract entities – classes and truth-values or properties and propositions.

Church accepts, with some emendations, W. V. O. Quine's criterion of ontological commitment: "The assertion of $(\exists x)M$ carries ontological commitment to entities x such that M" (1958, p. 1014). This is a schema in which 'x' may be replaced by any variable,

'*x*' may be replaced by any name of that variable, 'M' may be replaced by any open sentence with no other free variable except the aforementioned one, and '*M*' may be replaced by any name of the propositional form. And '∃' and the parentheses are here used as names of themselves with juxtaposition denoting juxtaposition. This is an improvement on Quine's criterion in two respects: it applies to theories allowing possibly empty individual domains and it yields directly (what Quine's test yields indirectly) a test for commitment to kinds of entities constituting less than the entire range of a variable.

According to Church, the importance of such a criterion derives from the frequency with which proponents of the negative in an ontological debate violate it and fall into incoherence. It was (and is) common to speak as if there *are* propositions, properties, and the like, and, when directly confronting the question, to deny that such things *exist* – and this without ever providing anything like a precise theory incorporating a distinction between existence and, say, mere being.

In an important critical paper (1950), Church argues against attempts to analyse belief and assertion by having them refer to sentences instead of propositions. Here occurs the 'Translation Argument'. Roughly the point is that statements of belief and assertion translate into various languages and can be directly understood by native speakers, but any analysis mentioning particular sentences of particular languages (using quotation and the like) will not have this property. Hence, it is concluded, any such analysis must be incorrect. Another critical study (1973) examines Israel Scheffler's nominalistic attempt to provide an analysis which will reproduce the results of standard logical syntax without recourse to anything other than expression tokens. It is there urged (among other criticisms) that there probably do not exist sufficiently many physical tokens as may be required for Scheffler's purpose and that there is no criterion provided for the application of a key notion; 'rephrasal'.

Church's most important positive contribution to ontology is his philosophical and formal work on the Logic of Sense and Denotation (1951b; 1973–4). This is an attempt to formalize an intensional semantics or logic embodying Frege's ideas about meaning. Every independently significant expression is held to have a *sense* – what is grasped when the expression is understood – and (typically) a denotation. Expressions *express* their senses and *denote* their denotations (if any). The sense of a sentence is a proposition; the denotation is a truth-value, truth or falsity. Predicates express properties and denote classes or, better, functions from objects to truth-values. A proper name or definite description expresses an individual concept and denotes (if anything) an individual. The sense of an expression is said to be a *concept of* the denotation of the expression. And in general anything capable of being the sense of an expression in some (possible) language is called a *concept*. The Logic of Sense and Denotation, in spite of its name, deals directly with the principles governing concepts and the concept relation. Thus it is not explicitly about language, rather it is pure ontology.

In (1954) Church criticizes Rudolf Carnap's proposed criterion of synonymy for complex expressions and offers an emended criterion. Complex expressions are held to be synonymous if and only if one can be obtained from the other by alphabetic change of bound variables or by a series of replacements of predicate or individual constants by synonymous expressions – or vice versa, primitive synonymies being given as part of the language. The ontological importance of this is that it gives, in terms of relatively concrete ideas about language, an intuitively plausible and precise definition which determines (at least in part) the relation between an abstract concept and its simpler constituents.

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C. ANTHONY ANDERSON

Chwistek, Leon

Leon Chwistek (1884–1944) was a Polish logician and philosopher. A student of Jan Śleszyński (1854–1931) and Stanisław Zaremba (1863–1942), Chwistek was a lecturer at the University of Cracow until 1930, and then became professor of mathematical logic at the University of Lvov. His interests covered not only logic and philosophy but also, for example, aesthetics; he was a talented painter. He was something of an outsider, and left no group of followers.

During the 1920s Chwistek developed a mathematico-logistic system broadly within the tradition of the *Principia Mathematica* of Alfred North Whitehead and Bertrand Russell but containing also elements of Hilbertian formalism. He anticipated some distinctions soon to be made (more clearly) by F. P. Ramsey on the division of paradoxes into mathematical and semantic kinds and a companion splitting of type theory into its 'simple' and 'ramified' varieties (in fact, he introduced the name 'simple' in this context).

Chwistek advocated a nominalist epistemology, this in connection with an opposition to metaphysics and an advocacy of 'sound reason'. He also strongly affirmed pluralism in regard both to theories (for example, the different formulations of set theory) and to reality (in particular, natural objects, artefacts, ideas and sensations were not reducible each to another). His book *The Limits of Science* (to quote the title of the revised English edition of the Polish original of 1935) tried to cover the full range of his concerns by passing from a mathematico-logical system (including 'rational metamathematics') through 'problems of the methodology of the exact sciences' to 'the problem of reality', in all its many-sidedness. In the same spirit he proved in 1939 that Kurt Gödel's incompletability theorem was true for his kind of system (so that a plurality of further systems would be formulable, in the usual way).

Chwistek's other writings, many of which appeared only in Polish, concerned the same network of questions, and manifested similar kinds of philosophical preferences.

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IVOR GRATTAN-GUINNESS

Clauberg, Johannes

Johannes Clauberg was born on 4 March 1622 in Solingen, Westphalia. His early schooling took place there, and after a short stay in Cologne, he studied from about 1637 to 1639 at Merson, in the Netherlands. He then studied theology, philosophy, and oriental philology at Bremen until sometime around 1644, when he entered the University of Groningen. Here his philosophy teachers and friends included Martin Schook and the Cartesian Tobias Andrea. In 1646 he travelled to France, where he spent some time in Paris studying with philosophers and theologians. After this he spent some time in England, after which he returned to Groningen. The prince of Nassau appointed Clauberg professor of philosophy and

theology at Herborn in 1649. He did not immediately take this appointment, but instead spent a summer at Leiden, where he studied the philosophy of René Descartes, primarily under the tutelage of Jean de Raey. He remained at Herborn until 1651, when he was appointed professor of philosophy and theology at Duisburg. He remained there until his death on 4 February 1665. His most important metaphysical work is the *Elementa Philosophiae Sive Ontosophia*.

Clauberg, who is best described as a 'Cartesian scholastic', held that *ontosophia* is that science which studies being in so far as it is being (*ens quatenus ens*), which according to Clauberg includes the notion of being which is common to corporeal and incorporeal beings, that is, to God and creatures. Whether this common notion of being is univocally or analogically predicated of God and creatures does not seem to be a pressing question for Clauberg since he invites his reader to choose whichever option he prefers.

Clauberg claims that there are three distinct meanings of 'being'. First, 'being' denotes everything about which we can think, and he calls this 'intelligible being'. There is no notion for the opposite of being in this sense. Suppose there were something opposite to intelligible being. What would it be? Presumably, non-intelligible being or non-being. But, if we can call this 'non-intelligible being' or 'non-being', then we can talk about this and write about it, and therefore think about it. But Clauberg defines 'intelligible being' as "that which can be thought or said" (§6). Thus, non-intelligible being is actually a form of intelligible being. Therefore, since there is no possible name for the unnameable, the opposite of intelligible being cannot be named (§9). Clauberg follows Clemens Timpler (1567–1624) by making intelligible being the most general object of metaphysics. In its second, narrower sense, being is 'something' (*aliquid*) and is opposed to 'nothing' (*nihilo*). 'Something' is that about which one can think, and involves no contradiction in our thought (§18). It would therefore seem that Clauberg wishes his existential quantifier ($\exists x$) to range over possible objects, not only actual ones. Thus, to say of a that $(\exists x)(x = a)$, or 'a is Something', is to say that either a exists or *could* exist (*adeo ut judiemus id esse in rerum natura aut saltem esse posse*). Furthermore, Clauberg does not equate possibility with mere thinkability, since intelligible being seems to include impossible things like the square circle (§§18 and 38). Clauberg thus believes that we can think about impossible things. Beings in the third sense are normally called substances, and we would call these particulars (§44).

This tripartite division of being should not be considered Cartesian; rather it reminds one of the extremely well known notion of term extension or 'ampliation' which was the subject of lively discussion among the logicians of the 16th century. Almost all logicians accepted the fact that in some sentences (for example, the modals) terms like 'man' referred to the class of *possible* men, not simply the actual ones. Beyond this, some logicians posited a kind of ampliation according to which the terms extended to *impossible* 'entities', such as chimeras. If scholastic logic is the original source of Clauberg's doctrine, then he is showing his dependency on scholasticism and not Cartesianism by asserting it.

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Cognitive Science

This is a collective name referring to an aggregation of disciplines – cognitive psychology, linguistics, philosophy, artificial intelligence, and at times the neurosciences –

brought together by the programmatic ideal of explaining the workings of the human mind. So far, the development of cognitive science has been guided by the notion that cognition must be understood functionally, formally, and internally – *functionally*, because cognition consists in a number of cognitive functions operating in specific modalities (such as vision, language production and understanding, memory recall) executed co-operatively by structures and processes whose hardware is not essential in any particular form; *formally*, because the executing structures and processes are causally efficacious only in virtue of their shape or structural organization, not in virtue of their hardware composition; and *internally*, because the cognitive functions executed formally owe their nature and laws of operation to an internal program (as a set of rules and instructions), not to a surrounding environment.

The resulting notion is that of cognition as computation of representations. A *representation* is a symbolic structure, that is, an organization of physical tokens (symbols) whose function is to systematically covary with, and thus be about, certain properties and events. A *computation* is a physical process which operates on such symbols and symbolic structures under rules which are sensitive only to their shape or form. This notion of cognition presupposes an internal code of representation (also called 'language of thought') in which representations are expressed, and a set of formation and transformation rules (the program) for the formulae of the language. The latter is held to encode the outputs of peripheral (visual) as well as central (reasoning, memory) cognitive functions. The pervasiveness of the language of representation explains not only how organisms process information at various levels of complexity and in various modalities (by computing and representing it) but also how these levels and modalities interact and co-operate (by exchanging results of computations in a common code). The computational and symbolic paradigm of cognition thus assumes that the essential business of cognitive science is to categorize and explain the formal program of the mind as it computes symbolic representations in cognitive modalities such as vision, memory, and language (Fodor 1983, Pylyshyn 1984, Haugeland 1985, Stillings *et al.* 1987).

The notion of cognition as formal computation of representations makes a number of important assumptions. It assumes token (but not type) physicalism because only the symbol tokens (but not their types and laws) are physical since instantiated by hardware and caused by the environment. The notion also assumes the autonomy and the exclusively internal range of the cognitive scientific explanation because the types and laws of cognition, which function as premises in explanation, characterize an internal program whose nature is independent of both its hardware and operating environment. Another assumption is that of innatism. Any cognitive representation must be computed and expressed in a symbolic ('language of thought') form, and any learning of how to do that, being itself a computational process, requires a still prior and possibly more complex language in which it must be expressed, and so on, in a regress and ever increased complexity that only innatism can stop.

That cognitive science should have emerged and still be under the influence of the computational and symbolic paradigm is no historical accident. In its immediate pedigree, cognitive science reflects the influence of two revolutions, one in understanding language, the other in understanding and building computers. Noam Chomsky has shown that to understand language processing as a cognitive competence we would have to isolate a formal program (the grammar) which computes only the correct sentences of natural languages, and does so irrespective of the particular meaning of the sentence and its physical form. The spirit of Chomsky's approach to language has been recently extended to the analysis of vision (Marr 1982), and in general appears to be successful in the analysis of the modular processes of cognition which are responsible for the production (as opposed to the subsequent utilization) of representational structures (Fodor 1983). The computer has not only provided a vivid and powerful model of what the cognitive mind might be like and of how it might

work; it has also tested and verified the key philosophical insight of cognitive science (that cognition, although a physical process, can only be understood in terms of formal structures and rules) by showing practically how a piece of hardware can be functionally organized to realize and operate on symbol structures (Pylyshyn 1984, Haugeland 1985).

There is, of course, a more distant and largely philosophical pedigree of cognitive science. The rationalists in the tradition of Plato, René Descartes, Leibniz had argued for innateness and a formal view of the mind. Thomas Hobbes was the first to think of cognition as mechanical computation over mental symbols. Claiming that we are built in ways which ensure space and time perception and at the same time limit the information we have access to, Kant may have been the first proponent of the notion of a functional architecture of cognition (in the sense of Pylyshyn 1984 and Fodor 1983). The empiricists in the tradition of John Locke and David Hume had advocated a combinatorial mechanics of concept formation and mental induction (Haugeland 1985).

Recent developments in cognitive science show some natural signs of rebellion against the computational and symbolic paradigm. There are vigorous neuroscientific attempts to map and explain the program of cognition in terms of neural hardware and its functional organization (Churchland 1986). There is also the increasingly popular connectionism which attempts to understand our cognitive program at an intermediate level, between the symbolic and the neural, by showing that the mind is run in a parallel fashion by computational processes which behave dynamically and continuously, as opposed to sequentially and discretely (McClelland *et al.* 1986, Churchland 1986).

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RADU J. BOGDAN

Colour

It was Democritus (*c.* 460–*c.* 370 BC) who first raised the problem of the ontological status of colour, and proposed a radical solution: "By convention colour exists, by convention bitter, by convention sweet but in reality atoms and void". These were roughly the terms of 17th-century discussions also, with 'in the mind' replacing 'by convention'. Many philosophers in our own century have found the logical geography of mental contents puzzling, and have once more sought to locate colours amongst the properties of physical objects. Some have held that colours are elementary properties of physical objects in addition to those described by physics. But the known processes of colour vision account effectively for experiences of colour without making any appeal to such elementary colour properties, so these properties would seem to have no epistemic role to play. Perhaps, then, the colours of objects are to be identified with the complex, higher-level characteristics of bodies, such as spectral reflectance, that are known to play an important part in colour vision. However, objects with similar spectral reflectances can be seen as dissimilar in colour, and objects with dissimilar reflectances can look similar in colour. There are no known physical criteria for accurately categorizing reflectances as reds, yellows, greens, and blues; one must rely on the visual systems of human beings or similar animals to perform that task. This suggests that we classify an object as, say, red, if it looks red to a normal observer under standard conditions. Unfortunately, a close look at the practices of visual science makes it apparent that there are no all-purpose 'standard conditions' for

determining 'the true' colours of objects, and that the colour matches reliably made by one 'normal observer' will not completely agree with those reliably made by another. Furthermore, one must give an account of what it is for an object to *look* red that does not in turn depend upon an antecedent understanding of what it is for an object to *be* red.

One might choose to meet the latter difficulty by returning to a Lockean stance, supposing that sense-impressions are the primary bearers of colour, and that physical objects may be said to be coloured only in a derivative sense. Usually advocates of this position are committed to mind–body dualism with respect to sensory qualities. But there is nothing in our rapidly evolving knowledge of the visual system to suggest that dualistically conceived sense-impressions have any role to play in understanding why we see colours as we do; all of the work seems to be done by neural processes. On the other hand, if coloured sense-impressions are epiphenomenal, they can play no part in the colour discriminations we make or the beliefs we have about the colours that we see. We might therefore adopt the neo-Democritean position that there are, in the last analysis, no colour bearers at all, but only chromatic experiences, and that these are identical with neural processes. Such a response is subject to the usual objections to mind–body identity theories. Beyond that, it buys consonance with current science at the cost of maintaining the paradox that nothing is, after all, coloured. What was to be explained is, instead, explained away.

Colours have also attracted philosophical scrutiny because it seems so difficult to explicate the relationships that they bear to each other. On the one hand, tradition has it that colours are paradigmatic simple and unanalysable qualities. But on the other hand, they have generally been held to be a closed family whose members are bound to each other and differentiated from each other by a set of necessary relations, e.g. orange is reddish and yellowish, pink is lighter than crimson. What binds the members of the family together? What properties differentiate them? And by virtue of what features do some colours exclude others? For instance, red cannot be coinstantiated with green: this has been generally acknowledged to be a necessary truth. But, given that redness and greenness are simple qualities, what could be the ground of that necessity? Is it based on the nature of the world or of ourselves, or does it rest on a convention of language? That something more than the latter is involved is suggested by the fact that redness and yellowness commonly occur together in the red-yellow we know as orange, but red-greens are conspicuously absent from experience as well as imagination.

Most philosophical discussions of these matters have been unsatisfying. However, recent advances in the study of colour vision prove suggestive. The current, neurophysiologically confirmed scientific account is that colour vision arises in consequence of the following process. Quanta of light are captured by three classes of photoreceptors in the retina of the eye, each of which is 'tuned' to a characteristic band of wavelengths; those bands are broad and overlap considerably. By means of other retinal cells, the outputs of the photoreceptor types are summed and differenced to yield an achromatic (black and white) channel, a red-green channel, and a blue-yellow channel. Each of the chromatic neural channels is antagonistically configured, so that the red-green channel cannot signal both red and green at the same time, and the blue-yellow channel cannot signal both blue and yellow at the same time. Whether this antagonistic configuration is characteristic of the most central neural mechanisms in the visual system is not yet known, but in the natural course of colour vision all colour coding has this antagonistic form. This explains why we see red-yellows and green-blues but not red-greens or yellow-blues, and it also suggests why we can imagine the former and not the latter. Appeals to such mechanisms as these may not suffice to settle the vexing questions of the relations that colours bear to each other, but they indicate that much of the received philosophical wisdom on these matters ought to be re-examined.

A similar re-examination was forced on the philosophical community in the 1970s when the path-breaking work of B. Berlin and P.

Kay seriously questioned the widely held doctrine, particularly dear to Wittgensteinians, that colour categories are induced in the continuum of visual experience by language. Berlin and Kay isolated a small set of 'basic' colour terms and showed that the paradigmatic exemplars ('foci') of these terms are remarkably constant across a variety of unrelated languages. It is noteworthy that these foci largely correspond to the basic colours picked out by contemporary colour-vision theory. The prevailing thesis was thus stood on its head: the biology of human colour vision structures experience which in turn induces a scheme of semantic categories in natural languages.

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C. L. HARDIN

Combinatorics

The mathematical discipline of combinatorics is concerned with the study of configurations of discrete (usually finite) systems. Relevant aspects are:

1. Existence: does there exist a configuration with specified properties?
2. Enumeration: what is the number of configurations of given specification and size?
3. Construction: how can one systematically construct configurations satisfying a given specification?
4. Analysis: are there interesting properties other than the specified ones that are satisfied by the configurations obtained?
5. Optimization: how can one find among all configurations of specified type those which are optimum with respect to some numerical parameter?

Combinatorial problems and methods can be traced back to ancient mathematics (e.g. magic squares, precursors of Pascal's triangle), but a systematic development was initiated only in the 17th century, due to the emergence of the field of probability theory (Pierre de Fermat, 1601–65; Blaise Pascal, 1623–62). The *Ars Conjectandi* (1713) by Jakob Bernoulli (1654–1705) can be considered as the first genuine combinatorial treatise. The name 'combinatorics' itself goes back to Leibniz's *Dissertatio de Arte Combinatoria* (1666). A considerable extension, both in technique and applications, is due to Leonhard Euler (1707–83). His method of *generating functions*, extended by Pierre Simon de Laplace (1749–1827), relates the enumerative problems of combinatorics to the techniques of classical analysis.

The development up to and including the first half of our century, when combinatorics was often seen as a part of 'recreational mathematics', was generally moderate, even though, for example, George Pólya's theory of counting under symmetry constraints opened the door for applications in many fields of science. There has been an explosive growth of combinatorial research activities in recent decades, quite often induced by the needs of other disciplines inside and outside mathematics. Modern combinatorics can roughly be grouped in three main fields:

a. Problems of classical type, mostly dealing with aspects 2. and 3. above, with applications in computer science, natural sciences, and mathematics.
b. Problems of 'geometric' character, i.e. the study of structures with a high degree of regularity and symmetry (e.g. finite geometries, block designs, codes), with aspects 1., 3., and 4. dominating. Important practical applications range from statistics (experimental design) to communication theory.
c. Graph theory, which deals, mostly under aspects 1., 2., and 5., with structures specified or represented as binary relations. Fields of application include most parts of science and technology, but also economics, linguistics, artificial intelligence, and social sciences.

As for applications of philosophical relevance, enumerative and graph-theoretical methods have been employed for investigations on the efficiency and limitations of logical proof systems.

It has often been said that combinatorics produces interesting isolated results, but fails to develop a coherent body of theory. This opinion is reflected by the fact that Bourbaki's monumental canon of modern mathematics hardly mentions combinatorics. Significant contributions towards a better systematical understanding of combinatorial methods are particularly due to Gian-Carlo Rota's series *Foundations of Combinatorial Theory* (see M. Aigner's book, written in this spirit, for references).

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VOLKER STREHL

Common Notion

According to the Stoics, all notions derive from sense perception. However, the production of some notions requires instruction and methodical investigation while others arise spontaneously. These spontaneously acquired insights or natural notions flow, without any special mental attention, from sensation or from the memory of sense perception. This occurs either directly or in such a way as to be mediated by some simple mental operation. The results are called 'common notions' (κοιναί ἔννοιαι) or, inspired by the Epicureans, 'ingrained prenotions' (ἔμφυτοι προλήψεις), in so far as they express the most basic features of the objects conceived and arise naturally in the minds of all those men who do not allow themselves to be deluded by false opinions. Considering the necessary harmony between nature and truth, the natural origin of common notions guarantees their validity. Moreover, they are absolutely self-evident and precede all other notions. Accordingly they lie at the root of philosophy, and thus in particular of physics, ethics, and logic, and they function as the necessary starting-points of all reasoning and investigation.

In the course of time this theory underwent several changes. In Book I of Euclid's *Elements*, the expression 'common notions' figures as a synonym of 'axioms' in the Aristotelian sense of absolutely certain principles of science. Thus by common notions geometers do not understand the most general ideas, but fundamental propositions which express logical relationships and which, because of their clarity, are naturally and directly accepted by everyone as unquestionable truths. Cicero (106–43 BC) typifies common notions as 'instinctive . . . or rather innate cognitions' and seems to identify them with Platonic innate ideas. Moreover, he suggests that these notions derive their truth from the fact that they are naturally shared by all men. Thus they are 'common' not so much in a logical as in a sociological sense of the word (*De natura Deorum* I, 43–5). Boethius identifies common notions (*communes animi conceptiones, regulae, termini*) not only with demonstrative axioms but also with topics, that is, the merely probable principles of dialectic. In this sense they are styled 'highest propositions' or 'maxims' (*maximae propositiones*). This tradition was kept alive until the end of the Renaissance and was supported by the revival of Stoicism near the end of the 16th century.

Especially in the 17th century, many philosophers advocated common notions – in the sense of innate dispositions or inclinations to acquire certain insights or to act in accordance with certain moral principles – as the cornerstones of religion, ethics, and science. Thus Lord Herbert of Cherbury (1583–1648) tried to settle the dispute between dogmatists

and sceptics and to bridge the gap between reason and religion by means of a theory of truth based on the idea of common notions as the generally accepted and therefore necessarily true products of a natural instinct (*De veritate*, 1645).

René Descartes conceived common notions primarily as the first principles of science. They do not spring from a natural instinct as such; rather they flow from the 'natural light', that is, an exclusively human, innate faculty of producing certain necessarily true and self-evident ideas. In Descartes's view the distinguishing mark of these ideas is not universal consent but their capacity to be clearly and distinctly perceived by a mind that is not clouded by prejudices (*Principia philosophiae*, Part 1, §§49–50; *Notae in programma Regii*, art. 12). This view of common notions also plays a prominent role in the philosophy of Spinoza and Leibniz. In his defence of common notions against John Locke's rejection of innate ideas, Leibniz adds to Descartes's natural light a separate moral instinct and sees common notions as natural habits to be distinguished explicitly from the innate ideas of Plato.

Rejecting both Humean scepticism and the theory that we do not know things themselves but only the ideas that represent them, Thomas Reid (1710–96) argues for the existence of common notions as the principles of common sense. In his view man is born with a number of intuitively known, unquestionable beliefs. These include not only necessary truths like the principles of mathematics and logic, but also contingent truths like the existence of a personal self, of the past and of the external world. Together with a number of no less self-evident theological and ethical principles, these natural intuitions, according to Reid, guarantee the objectivity of our cognitive powers as well as a true religion and morality.

In the 19th century the debate on common notions seemed to come to an end. Since the 1960s, however, they have been once more widely discussed among psychologists and linguists, in particular in the debate on innate cognitive mechanisms (see Stich 1975).

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JAN PRINS

Common Sense

The ontology of common sense is the discipline which seeks to establish the categories which are used in everyday life to characterize objects and events. In everyday life steel bars and window panes are solid objects. For the scientist, the glass of the window pane is a liquid, and the solidity of both the window pane and the steel bar is illusory, since the space they occupy consists mostly of empty regions between the sub-atomic particles which constitute these objects. These facts, however, have no bearing on the ontological categories of common sense. Sub-atomic particles and solid liquids do not exist in the domain of common sense. Common sense employs different ontological categories from those used in the various specialized disciplines of science.

Similar examples of differences between common sense and scientific ontologies can be multiplied at will. The common-sense world recognizes salt, which is defined in terms of its colour, shape, and, above all, taste. But the chemist deals with sodium chloride, a molecule consisting of sodium and chlorine atoms; taste has no existence in this world. To common sense, human beings are ontologically distinct from animals; we have language and reason, animals do not. To the biologist there is no such distinction; human beings are animals; language and reason evolved because they have survival value. Finally, consider the Morning Star and the

Evening Star. Only by moving from the domain of common sense to the domain of astronomy can we assert that these stars are not stars at all, but simply different manifestations of the planet Venus.

In all of these cases, the common-sense world is organized in terms of one set of object categories, predicates, and events, while the scientific accounts of the same phenomena are organized by different concepts. In his seminal discussion of natural kinds, W. V. O. Quine suggested that science evolves by replacing a biologically innate quality space which gives rise to natural kinds (in our terms, the categories of a common-sense ontology), with new quality spaces. However, Quine has little to say about just how scientific ontology evolved from common-sense ontology.

The Role of Logic. Quine argues that our sense of similarity among things is not well captured by the formal tools of logic, in terms of which it is quite natural that the greenness of leaves should confirm the blackness of ravens. This puts Quine at odds with Patrick Hayes, a researcher in artificial intelligence who has called for a systematic investigation of the conceptual categories of common-sense physics. For Hayes argues that first-order logic is the appropriate vehicle for this task.

One might argue that this question, the appropriateness of logic as a conceptual tool for the description of common-sense ontology, is a secondary matter. But that cannot be so. If one is to investigate common-sense ontology, one must have some conceptual tool in which the categories and their interrelationships can be stated. If logic is unsuited to the task, then Hayes's particular program cannot succeed, though his more general goal, a description of the common-sense world, still remains valid. More significantly, the role of logic has been so large in contemporary philosophy and in cognitive science that a definitive demonstration of its inadequacy to deal with common-sense categories may be an indication that it is not the universal descriptive tool it is so often assumed to be.

Some Empirical Evidence. Frank C. Keil has made the most systematic empirical study of common-sense ontology. Following the work of Fred Sommers, he asks us to consider sentences such as the following:

(1) The table was made of wood.
(2) The table was made of linguini.
(3) The table was hungry.

Examples (1) and (2) are sensible, though (2) is probably false. But (3) is anomalous; neither it nor its negation makes sense. This is because 'hunger' is an attribute which cannot sensibly be applied to inanimate objects. Such application violates our basic sense of ontological categories.

Using test instruments in which subjects are asked to judge whether or not various assertions make sense, Keil found a common-sense ontology in which *sentient beings* (primarily humans) and *non-sentient beings* (non-human animals) are types of *animal, animal* and *plant* are types of *living thing, living thing* and *functional artefact* are types of *solid object, solid object* and *aggregate* are types of *physical object, physical object* and *event* are types of *things with spatial location*, and *things with spatial location* and *abstract objects* are varieties of the covering category of *all things*.

Keil also studied the childhood development of ontological categories, concluding that development proceeds by making ever more refined distinctions. Thus, 5-year-olds seem to distinguish between living things and everything else and 7-year-olds recognize animals, plants, non-living physical things, and non-physical things.

Ethnobiology, the study of the classification of plants and animals in non-Western societies, provides other evidence (Berlin *et al.* 1973). The most relevant finding is that many cultures have no words which are equivalent to our *plant* or *animal*, but it is clear, however, that these various peoples can systematically contrast plants and animals with one another and with other categories. They act as though they recognize some ontological distinctions without having names for the categories thus distinguished. (This finding is consistent with the work of Eleanor Rosch, who has found that adults in our culture tend to refer to things at the level

of e.g. *carrot* or *lemon*, rather than e.g. *vegetable* or *fruit*.)

Alerted to this phenomenon, we can see it in Keil's data as well, though he doesn't discuss it. Some of the categories he found, such as functional artefact and abstract object, have no single-word designators in English. That we recognize such categories is indicated by our judgements of linguistic anomaly but, while we have long had words to designate the plant and animal categories, we do not yet have words to designate these other categories. This suggests that, in general, the ontology of common sense is not made fully explicit by the language of common sense. It would be interesting to find out whether or not this is true of philosophical and scientific ontologies as well.

Some Implications. That ontological categorization is partially unconscious may well be relevant to how we conduct our intellectual business. Consider the question of whether or not computers can think, or perceive, or feel. The question has been endlessly debated and the only thing which seems clear is that we have no deep and abiding consensus about the meaning of the predicates which we are attempting to assert or deny of computers.

Perhaps the difficulty is that we are, unwittingly, trying to use common-sense ontological categories for problems not suited to them; that, to recall an earlier example, we are talking of taste and texture (as in the common-sense notion of salt) where it would be better to talk of atoms (as in sodium chloride). In terms of the ontology Keil has identified, the issue is whether or not computers are sentient beings or functional artefacts. If we consider how they are constructed, then computers are clearly functional artefacts. If we consider how we interact with them, then they have kinship with sentient beings, for we interact with them through language. We do not have any linguistic interaction with the members of any other ontological category. We write messages to, and read messages from, only computers and other human beings.

Thus computers cannot be unambiguously situated in our common-sense ontology – just as, almost two centuries ago, the invention of the steam locomotive created functional artefacts having powers of autonomous motion previously found only in animals. Perhaps the way to deal with the status of computer intelligence is simply to abandon the attempt to situate computing in the ontological system of common sense, to abandon the issues of computer mentation as being conceptually ill-formed. Instead we should seek an ontology more suited to the problem.

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WILLIAM L. BENZON

Complexe Significabile. See: Gregory of Rimini

Concept

Concept or notion, in Latin *conceptus* or *notio*, in German *Begriff*, means the simplest content of our thinking, both in a psychological and in a non-psychological sense. In the first case it stands for a mental act; in the second for its content. The scholastic–rationalist tradition, including such modern representatives as Bernard Bolzano and the members of the Brentano School, distinguished in this sense between *conceptus subiectivus*, a mental act, and *conceptus obiectivus*, its content. The term '*notio*' seems to be more psychological, if only in that the tradition knows no *notio obiectiva*. Subject-

ive concepts might therefore be called 'notions'.

I begin with the relation of *falling under* between individuals and concepts, a relation well known since the *Categories* of Aristotle and nowadays commonly associated with Gottlob Frege (see Angelelli 1967). In connection with this relation are the species or natural kinds of the individuals falling under a given concept. Such species in turn fall within *genera* at higher levels.

A central problem is the relations between concepts as mental acts and as contents on the one hand, and between both of these and reality on the other. Concepts mediate between the mind and reality. This mediating role of concepts is the foundation of the *triadic semantics* favoured for example by Aristotle, the Stoics, and the scholastic tradition.

Individual substances like Peter and this ox *fall under* concepts like human being, animal, body, substance; individual properties or accidents like this redness or this bitterness *fall under* concepts like redness or bitterness, colour or taste, quality or property. To each of the ten Aristotelian categories of substances and individual accidents there corresponds a hierarchy of concepts under which the relevant individuals fall.

It is this falling-under-a-concept of individuals which enables us to perceive individuals via concepts and to speak of them, for with few exceptions names are given to concepts and not directly to individuals.

Natural Kinds. Traditionally the relation of falling under a concept was expressed by its converse, namely by that of *de subiecto dici*, or the predication of a concept to a subject or substance. The concepts under which individuals fall have an interesting and characteristic structure, they form trees of greater and lesser generality. In the tradition they have been referred to as natural kinds, and the most famous tree of concepts is the *Arbor Porphyriana*, representing a tree of natural kinds in the category of substance. Later the Scholastics tried to construct trees also for the other nine categories, but these trees were never so well known as the tree of Porphyry.

There are different ontological and logical relations between natural kinds. If we begin at the base with individual substances and go up to the top-most natural kind, that of substance in general, then we have certain necessary inclusions: thus Peter is necessarily a human being, a rational animal, a sensitive animal, a living body, and a substance. But if we start with the topmost natural kind, that of substance in general, and go down to the individuals, we have a class-class, and ultimately a class-element inclusion relation, neither of which is such as to hold of necessity. Thus it is not necessary that there shall be aardvarks among the animals, nor it is necessary that there should be Peter among the humans. In this way we can, with the help of the *Arbor Porphyriana*, show the structure of both concept-concept or intensional relations and class-class, or class-element, or extensional relations. These structures are fundamental both for intensional and for extensional logics.

The Classification of Notions and their Content. The late medieval philosophers had a great deal to say on the ontological status of mental qualities, of cognitive powers and mental acts, and especially of notions.

David Cranston (1479–1512) thinks that John Duns Scotus and William Ockham gave a sufficient account of what a notion is in affirming that for something to be called a notion two conditions are required. The first is that it inheres in a cognitive power. The second is that it have an object as its term, that is, that by means of the notion this power knows some thing.

The definition of a notion given by Gilbert Crabs (1482–1522) takes care of the representative function of this quality: "A notion is a quality inherent in a cognitive power, vitally changing the power, and representing some thing or things to that power".

This representation was characterized as formal and its foundation is what the Scholastics referred to as a 'formal identity' between the content of a notion and the thing represented. To the *esse naturale* of the thing's form corresponds the *esse intentionale* of the content's form. The likeness of form in different objects and the capacity of form to be material in a material object and immaterial in an immaterial object makes representation possible.

Much of our knowledge is dispositional. Thus one has to distinguish between cognitive dispositions and actual notions. Cognitive dispositions are not notions, since they do not vitally change the cognitive power by exercising thought. They have a mediating role between a cognitive power and an act of that power, the notion proper.

Another distinction is that between direct and reflexive notions. Direct notions, for example my notion of Kirchberg, present their content without detour. Reflexive notions, for example the notion of my thinking about Kirchberg, are in every case connected with direct ones. They represent a direct notion and thereby represent what the direct notion represents. Thus I cannot think about my thinking about Kirchberg without thinking about Kirchberg.

Intuition and Abstraction. The tradition recognizes two methods for acquiring notions: intuition and abstraction. Intuition can operate only where the objects with which one begins are present to the subject. In this case the object has a direct causal influence on the subject's cognitive power. Intuitive notions, for example the notion of emotions like love or hatred, are held to be evident, and are also in every case singular. Gregory of Rimini (*c.* 1300–58) defines an intuitive notion as a simple notion by which some thing is known formally and immediately in itself. Intuition is the most perfect cognition. God's knowledge is purely intuitive.

Abstract knowledge, for example the knowledge of different kinds of empty classes, in contrast, does not imply the existence of the object known. The causal relation between the object and the abstractive notion is more complicated. The main difference between abstractive and intuitive notions is that the former are universal and thus nearer to science.

Gregory of Rimini defines an abstractive notion as a simple notion by which some thing is known formally in some representative medium. This definition reflects Aristotle's thesis that perception is effected by the mind of the perceiver taking into itself the form of the thing perceived, while leaving behind the matter. The similarity between an abstractive notion and its object is a formal one.

Triadic Semantics. Beginning with Plato's *Parmenides* and Aristotle's *Categories* and *De Interpretatione*, the tradition uses triadic semantics. This relates written signs to spoken ones and spoken signs to *concepts* – not directly to the things. These concepts can be psychological entities taken together with their non-psychological content, or they can be this content alone. The Stoics, too, follow the Aristotelian tradition of triadic semantics by introducing their theory of λέκτα.

Elaborated theories of triadic semantics are to be found in different scholastic periods. Generally the relation was characterized by means of the triplet *vox-intellectus-res* (word-concept-thing). Among the properties of a term which relates a sign to a concept is that which is called the *significatio*. This property may be possessed naturally, as with a notion, or conventionally, as with an utterance or an inscription. A notion of anything is itself a natural sign thereof. It is as it were a representative within the mind of the thing outside.

Beginning with the Scotists, another aspect begins to be important. If we relate our signs to a system of concepts and not directly to the things themselves, then we have to look more carefully at the concepts and especially we have to be sure that these concepts are free of contradiction – that they are 'possible' or 'consistent'. This will prove to be one of the main problems of 17th-century Scholasticism and rationalism.

Concept and Idea. The difference between concept and idea was discussed especially by the rationalistic philosophers. Every idea can be the content of a concept, but not every concept contains an idea. There are concepts which are inconsistent and therefore empty. Leibniz was the philosopher who had precisely formulated the Scotistic notion of the *possibile logicum*, or of its contrary: an inconsistent or impossible composite concept. A composite concept B is inconsistent iff it contains as part-concepts both some A and some corresponding non-A, and it is consistent or possible if it does not do so. (An example of an inconsistent concept is for Leibniz the concept of a maximal velocity, to which no idea corresponds.)

In order to understand his argument here, we have to accept the difference, mentioned

earlier, between *conceptus subiectivus* (also later called *conceptus formalis*) and the *conceptus obiectivus* or content. The first is a mental act or a psychological entity and can therefore exist even independently of the consistency or existence of its content. Even if a maximal velocity or a round square do not exist, there can still exist a corresponding mental act or *conceptus subiectivus*.

The three terms 'mental act' (*conceptus subiectivus*), 'content' (*conceptus obiectivus*), and 'idea' have to be distinguished in the following way. Mental acts are in and of themselves neither consistent nor inconsistent, and they exist independently of the consistency or inconsistency of their contents. The extension of all inconsistent concepts is the empty class, but their intension, however, is extremely rich. There are infinitely many different inconsistent concepts.

Consistency now, is a necessary but not a sufficient condition for ideas. In contradistinction to concepts, ideas cannot be arbitrarily constructed. There must be a relationship between ideas of the sort that exists between corresponding natural kinds. Ideas are the forms of the things in the world, and he who possesses the ideas is (at least from Leibniz's point of view) able to reconstruct the world, its history, and its future evolution.

Primitive Concepts, Combinatorics, and Discontinuity. Already in his *Sophist* and *Parmenides* Plato introduces the idea of simplest concepts, by combination of which all complex concepts can be produced. A big step forward in this direction was made by Raymond Lull in the 13th century. Lull is to be seen as the father of the combinatoric art.

Leibniz, too, was a Lullist. He always thought that there are primitive concepts, i.e. concepts without parts, and in his *Dissertatio de Arte Combinatoria* from 1666 he tried to give a list of these concepts. Later he came to the view that there are such *notiones absolute primae* or absolutely simple concepts, but that we cannot know them. We have to be content with *notiones quoad nos primae*, i.e. with concepts which are for us the simplest. The conceptual structure of our thinking is thus molecular and not atomistic. Thinking consists mainly in the combination of composite concepts. Like Raymond Lull and René Descartes, Leibniz postulates a *Scientia Generalis*, a discipline which has to provide the other sciences with their consistent composite concepts.

With Descartes, Leibniz holds that the idea of primitive concepts is strongly connected with that of a philosophical language or *lingua rationalis* which would stem from the analysis of natural language. The ideal rational language for Leibniz has a one-to-one semantics: i.e. primitive concepts are characterized by primitive signs. In this language material identity ($A = B$) cannot occur, there is only formal identity ($A = A$).

This programme, which can be called the Leibniz programme, was very influential. We find the idea later in Edmund Husserl, in Gottlob Frege, and in the *Tractatus* of Ludwig Wittgenstein.

Another problem discussed by Leibniz is the relation between concepts and reality. The fundamental difference between the two levels is that reality is continuous and concepts are discontinuous. We have to express the continuum of reality by a discrete system of concepts. This is a central problem for any epistemology which has its foundation in reality and does not strive to reduce ontology to epistemology.

Concept and Proposition. Leibniz is a logician of terms. For him the boundary between concept and proposition is a fluid one, and he often seeks a formulation of the elementary sentence (A is B) which allows him to move automatically from a composite concept to a proposition and back again. He finds it in the form of the scholastic *secundum* and *tertium adiacens*. Thus, for example, he can transform the proposition 'Peter is a human being' into 'Peter-the-human-being is possible or consistent' ((AB) *est ens*) which means that the composite concept Peter-the-human-being contains human being as part-concept. This analysis is also valid for contingent propositions like 'Peter is the husband of Susan' or 'Peter as husband of Susan exists' ((AB) *est existens*). Using this method, composite concepts are propositions and vice versa. We have at one and the same time a logic of terms and a logic of propositions.

Concept Versus States of Affairs. In logic and philosophy at the turn of the 20th century, we can observe a competition between concepts and states of affairs. The philosopher of the concept at this time is Frege. The term '*Sachverhalt*' was generally used by pupils of Brentano such as Carl Stumpf, but also by Adolf Reinach and Wittgenstein and by the German jurists and grammarians.

For Frege a concept is extensional; the concept 'human being' contains all human individuals; all human individuals fall under the concept 'human being'. He distinguishes from this the relation of subordination, i.e. the subordination of a concept under another concept, so for example the subordination of *human being* under *animal*. Subordination expresses the intension of a concept.

In his analysis concerning the difference between sense (*Sinn*) and reference (*Bedeutung*) Frege uses a kind of triadic semantics. He considers objects to be reached only via the senses which show us certain aspects of these objects. His famous examples are morning star and evening star as aspects of the object Venus. This difference between sense and reference was well known already by the Scholastics and by Leibniz. They called the approach to objects by senses or concepts *modus concipiendi* or the 'way of conceiving an object'.

In his theory of truth Frege understands concepts as special sorts of functions, yielding as value the true or false if they are rightly or wrongly applied to a given argument. Frege is a Platonic thinker, believing in the existence of truth and falsehood as rudimentary extrawordly states of affairs. Much more interested in epistemology and logic than in ontology, he never really understood the role of states of affairs as truth-makers in reality.

The reduction of concepts to functions eliminates that dimension of concepts which brings them into relation to psychological entities (concepts as contents of mental acts). Frege's anti-psychological attitude prevented him for this reason from profiting from the richness of the analyses of concepts provided by traditional philosophy.

Because of the dominating influence of Frege, the founder of contemporary mathematical logic, the partisans of states of affairs were for a long time in a weak position. These philosophers relate true propositions to states of affairs which are their truth-makers. In our time this position is gaining ground in virtue of the fact that some influential analytic philosophers, for example the partisans of situation semantics, are now interested in ontology and therefore also in the theory of states of affairs. The oldest attempt to combine and reconcile Fregean philosophy of function and concept with the ontology of states of affairs is, of course, the *Tractatus* of Wittgenstein.

The Ontological Status of Concepts. Subjective concepts are like psychological entities, immaterial; thus they are not in space but only in time. Mind contains concepts appearing in a temporal order. They are individual accidents from the category of quality each assigned necessarily to exactly one individual substance and being such, therefore, that they cannot migrate from one substance to another.

Concepts *qua* contents of psychological acts, on the other hand, are spaceless and timeless. They are not bound to one individual substance and can be both the content of different mental acts of one and the same individual and also of the acts of different individuals at the same time. This is common to the objective concept and the idea: both have properties like being timeless, spaceless, and universal.

Concepts are only indirectly dependent on language, namely via mental acts *qua* natural signs. Their affinity to mental acts is much stronger than to words or sentences. They can be expressed by words and they are invariant as between different languages, but they are not simply *façons de parler*, as some philosophers maintain. Their ontological status is a much more complex matter.

This can be shown by an old distinction. The Scholastics made a difference between two kinds of rational entities: the first is a rational entity with a foundation in reality – namely, for example, relations such as space and time; the second is a pure rational entity without any foundation in reality – for example, a chimera like a unicorn. It would be a serious error to conceive relational

entities like space and time as mere *façons de parler*.

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HANS BURKHARDT

Concepts, Open

Despite anticipations in Nietzsche (*Genealogy of Morals*, 2nd Essay, Section 13), the idea of an *open* concept – often referred to as an *open-textured* concept – was first explicitly used by Friedrich Waismann (1896–1959) in his 1945 essay in the *Proceedings of the Aristotelian Society* on the verifiability of empirical statements. Since the 1940s, the ideas of an open, and by contrast a closed, concept have been employed notably within the field of aesthetics, for example in the work of Morris Weitz. They have been used also in the fields of ethics and the philosophies of science and law.

Whether the doctrine of open and closed concepts can be made either lucid or consistent is questionable. Certainly, it has been made neither when understood in Waismann's particular terms. The best chance it has is when its proponent takes seriously Ludwig Wittgenstein's various remarks on meaning, unbounded concepts, and family resemblances in his *Philosophical Investigations*. For questions pertaining to open and closed concepts presuppose answers to traditional metaphysical questions concerning language, meaning, verification, and definition. Is language properly to be conceived as a mirror or as a tool-box? Can definitions be understood in ways other than *per genus et differentiam*? Are concepts to be treated in exactly the same way as essences, types, or common names?

Open concepts (for example, the concepts of democracy, justice, contract, and art) have been variously described but not unproblematically and usually in negative terms. They have been described:

1. as not corresponding to fixed or static essences;
2. as not admitting of 'absolutely precise' definition of the sort traditionally given in terms of necessary and sufficient conditions;
3. as intensionally incomplete – because the possibility of there arising an unforeseen situation which would lead us to modify our definition can never be eliminated;

or, finally:

4. as being distinct from although related to vague concepts. Thus, according to Waismann, a concept is vague if there are cases in which there is no definite answer as to whether the term applies. ('Pink', 'tall', 'bald', and 'middle-aged' serve as examples.) Open-texture is such that it provides for the (logical and empirical) 'possibility of vagueness'.

Given these descriptions, how are we to understand closed concepts? Are they to be understood (contra 1.) in essentialist or realist terms? No, since this would commit us to a view of meaning whose rejection gave way to the doctrine of open concepts in the first place. A distinction must then be drawn between what we might call fixed and closed concepts. Only the former function or find their expression within an essentialist view of the world. The doctrine of open *and* closed concepts, by contrast, is designed to sustain an anti-essentialist view.

Perhaps closed concepts are to be understood as those expressed in terms of (Carnapian) formal, or what have been called

ideal or exact, languages. This is unsatisfactory to the extent that it leads us to deny that there are concepts, such as of a quart and of a freshman, that are closed yet do not belong to what we strictly call a formal language. Nonetheless, we are moving towards a plausible description. According to this, closed concepts are taken to function within systems or practices which require a certain kind of formality where this symbolizes a certain kind of precision. Mathematical and logical systems are obvious formal languages. Measurement and monetary systems are examples of precise systems. The stratification of the House of Commons or of Cambridge University are examples of other kinds of precise systems.

Many concepts can be closed for certain purposes and open for others. For funding and insurance purposes, say, as opposed to purposes of criticism and aesthetic experience, many concepts most effectively function as closed. Whenever a concept is treated as closed, it is given an exact and complete definition in the light of a stipulation made at a given time 'for a special purpose'. The definition is given in intensional or extensional terms, or both. More importantly, it stipulates boundary conditions. In closing a concept we decide that it is to be used if and only if the relevant objects have certain features or properties. We recognize, however, that the stipulation is dependent upon the use to which we want to put the concept. Thus, when we want to change the system and thereby the use of the concept, we change the definition. Although we might continue to use the same name, we are using a new concept because we give up the old definition and replace it with a new one.

Open concepts are different. Because they function within a different kind or part of practice, their definition does not require a stipulation of boundary conditions. When we treat a concept as open we treat it as unbounded. Its definition need be confined only to known or uncontroversial, canonical, or paradigm examples. Open concepts are treated in such a way that they can undergo alteration in their definition without losing their identity as new examples come to appear as standard, as the practice within which they function changes. Unlike definitions of closed concepts, those of open concepts are expanded and modified but not replaced. Open definitions, if one may call them that, are not treated then as rigid or fixed, but as 'signposts' facilitating language use. They are mutable and flexible in the light of developing descriptive and prescriptive functions.

The lesson of this doctrine is that it is the use to which we put a concept rather than the logic or nature of a concept *per se* which determines whether the concept is to be treated either as open or as closed. This lesson is entirely consistent with three basic Wittgensteinian tenets concerning language and meaning:

1. objects falling under a given concept need not share a common property, be that property exhibited or non-exhibited, internal or external;
2. natural languages are not fully determinate and the rules governing them not fully circumscribed;
3. at least some concepts are adaptable according to their role in activities and theories.

In sum, the possibility of accounting satisfactorily for the distinction between open and closed concepts depends upon the removal of a traditional, realist theory of language and meaning, and upon the construction of a theory which takes seriously the fact that language and conceptual use is something over which language users have control.

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Conceptualism

Conceptualism is one of the three types of theories regarding the nature of universals described by Porphyry in his *Introduction to Aristotle's Categories*. The other two are nominalism and realism. Because a universal, according to Aristotle, is that which can be predicated of things (*De Int.* 17a39), the difference between these three types of theories lies in what it is that each takes to be predicable of things. In this regard we should distinguish *predication in language* from *predication in thought*, and both from *predication in reality*, where there is no presumption that one kind of predication precludes the others.

All three types of theories agree that there is predication in language, in particular that predicates can be predicated of things in the sense of being true or false of them. *Nominalism* goes further in maintaining that only predicates can be predicated of things, that is, that there are no universals other than the predicate expressions of some language or other. *Conceptualism* opposes nominalism in this regard and maintains that predicates can be true or false of things only because they stand for concepts, where concepts are the universals that are the basis of predication in thought. *Realism* also opposes nominalism in maintaining that there are real universals, viz. properties and relations, that are the basis of predication in reality.

The relationship between realism and conceptualism is more complex than the simple kind of opposition that each has to nominalism. In particular, whereas certain forms of realism, such as logical realism as a modern form of Platonism, are incompatible with conceptualism, other forms, such as natural realism, of which Aristotle's moderate realism is a type, are not only compatible with conceptualism but have been intimately connected with it in one way or another throughout the history of philosophy – though not always in an unproblematic way.

Peter Abelard, for example, in his *Glosses on Porphyry*, provides an account that is very much like Aristotle's in being both conceptualist and realist. In combining these positions, however, he does not entirely distinguish the universals that underlie predication in thought from those that underlie predication in reality. That is, a universal, according to Abelard, seems to 'exist' in a double way, first as a common likeness in things, and then as a concept that exists in the human intellect through the mind's power to abstract from our perception of things by attending to the likeness in them. The realism in question here is not a Platonic or *logical realism*, where a property or relation has its being outside the natural or causal order and does not depend on whether or not anything has (or even *can* have) that property or relation. Rather, it is a moderate or *natural realism*, where a property exists only in the causal or natural order and as a common likeness in things – but yet where, even if those things were to cease to exist, it would still somehow exist in the human intellect as a universal concept.

Aristotle also seems to have assumed that universals could exist in this double way, though it is possible to interpret him otherwise as well, especially in his discussion in the *Posterior Analytics* of how concepts such as *being a chimera* or *being a goat-stag* can be formed otherwise than by abstraction. The point is that when conceptualism is combined with natural realism, as it was for Aristotle and Abelard, we should be careful to distinguish the universals that underlie predication in thought from those that underlie predication in reality. Indeed, a basic ontological assumption of all contemporary forms of conceptualism is that concepts, unlike real universals, exist only *in intellectu*, which means that they do not exist independently of our capacity for thought and representation.

Conceptual natural realism, as the (reconstructed) type of theory of universals described by Aristotle and Abelard (but in which they may differ as to sub-type), does not identify the universals that underlie predication in thought with those that underlie predication in reality. In fact, to the contrary, the concepts that are the basis of predication in thought are distinguished from the real properties and relations that are the basis of predication in reality, i.e. of the states of affairs that obtain in nature. Instead of being identical with a real universal, a concept is said to represent it – if in fact there

is such a real property or relation corresponding to it in nature. It should be noted, however, that even if a concept purports to represent a real property or relation in nature, that does not mean that there is in fact such a real property or relation corresponding to it. Indeed, in general, there will be no such real universal corresponding to many, and probably most, of the concepts formed by the human intellect. This means, according to conceptual natural realism, that any assumption to the effect that there is a real property or relation in nature corresponding to any given concept is always to be construed as a scientific hypothesis subject to confirmation or falsification (cf. Cocchiarella 1986, Chapter 4, and Cocchiarella 1988, Sections 13–14).

It is this distinction between predication in thought and predication in reality that is fundamental to all forms of conceptualism. The ontological ground of the distinction, as already noted, consists in the fact that concepts, according to a basic assumption of conceptualism, do not exist independently of our capacity for thought and representation, i.e. that concepts exist only *in intellectu*. Although this basic assumption is itself a metaphysical thesis, one of its consequences, which is a corollary of the distinction it implies between predication in thought and predication in reality, is that conceptualism, as a theoretical account of the nature of thought and representation, involves a shift in emphasis from metaphysics to psychology. As part of this shift, a second, related assumption maintains that all thought, and in particular all mental acts such as judging, doubting, desiring, etc., including all perceptual acts such as seeing, hearing, feeling, etc., must be grounded in psychological states and processes that do not have abstract objects as constituents. It is this assumption, together with the first, that leads to the incompatibility between conceptualism and logical realism as a modern form of Platonism.

Logical realism differs from natural realism not only in its claim that properties and relations exist independently of the natural or causal order, and therefore of our capacity for thought and representation as well, but also in its assumption (in the form of an impredicative comprehension principle) that every predicate expression (complex or simple, and including even contradictory ones) stands for such a logically real property or relation. Another assumption apparently is that concepts are properties in just this sense, and therefore, contrary to the first fundamental thesis of conceptualism, concepts do exist independently of our capacity for thought and representation after all. This is not entirely a terminological matter, moreover, or at least not in Bertrand Russell's form of logical realism, where, in addition to calling properties and relations concepts, he also assumes that the mind can be directly related (by a relation that he calls *conceiving*) to properties and relations as objects of thought – i.e. where such abstract objects as properties and relations are constituents of thoughts as mental acts, contrary to the second fundamental thesis of conceptualism. But even if logically real properties and relations are not assumed to be objects of thought – as they cannot be in a logical realism such as Gottlob Frege's, where, because they are unsaturated functions, properties and relations are not objects to begin with – there is still the assumption that what the mind is related to in particular acts of thought, such as a judgement, are propositions, which in logical realism are also abstract objects that exist outside of the natural or causal order. That is, in all forms of logical realism there are abstract objects, whether these be propositions or logically real properties and relations, that are constituents of particular mental acts, and it is for this reason, even aside from any terminological confusion about the notion of a concept, that logical realism is incompatible with conceptualism. (We might also note here, incidentally, that in logical realism, but not in conceptualism, or at least not in conceptual realism as we describe it below, a proposition is usually assumed to be the same as a state of affairs, i.e. the result of a predication in reality. Such an identification, according to conceptual realism, amounts to a conflation of the intensional order, to which propositions belong, with the natural or causal order, to which states of affairs belong. A proposition is not a state of affairs in conceptual

realism, in other words, but is rather an intensional object that is denoted by a nominalized sentence as an abstract singular term, and as such it is not assumed to exist independently of our capacity for thought and representation.)

Although conceptualism precludes logical realism as a modern form of Platonism, this does not mean that conceptualism is committed to a rejection of Platonism in all its forms. In fact, there is another combination of conceptualism with realism, viz. *conceptual intensional realism*, that may also be described as a modern form of *conceptual Platonism* (cf. Cocchiarella 1986, Chapter 5, and Cocchiarella 1987, Chapter 2). On this account, Platonic forms, which traditionally are also called properties and relations (but not in the sense of natural realism), are not what predicates stand for (since predicates stand for concepts, which exist only *in intellectu*). Rather, they are the intensional objects that are denoted by abstract singular terms (i.e. names), and in particular the abstract singular terms that are the result of syntactically transforming a predicate into one of its nominalized forms – the way, for example, the predicates 'wise' and 'triangular' are transformed into 'wisdom' and 'triangularity', respectively. In other words, corresponding to the concepts that the predicates 'wise' and 'triangular' stand for, there are, on this account, the Platonic forms (intensional objects) that are denoted by the abstract singular terms 'wisdom' and 'triangularity'. It is, of course, absolutely crucial that we distinguish in this framework not only the syntactic role of predicates as predicates from that of their nominalized forms as abstract singular terms (i.e. as names) but also their semantic roles as well. Indeed, as the basis of this distinction, there is assumed in this framework a correlation of objects with concepts that semantically underlies the syntactic operation of nominalization (which transforms predicates into abstract singular terms). Such a correlation amounts, in effect, to an *'object'-ification* of concepts, which from a semantical point of view can be described as an ontological projection into the domain of objects in general of the truth conditions determined by the different possible applications of our concepts. That is why the object that is picked out by means of such a projection can be said to be the intension or content of the concept whose 'object'-ification it is. It is in terms of this projection, in other words, that we are able to explain how, by means of our conceptual abilities, we are able to lay hold upon the intension of a concept as a real Platonic form (i.e. as an abstract object), by starting out from the concept as an entity that exists only *in intellectu*.

Conceptualism is compatible not only with an Aristotelian natural realism and a Platonistic intensional realism as described above, but also with both together. This is because the intensional objects that are denoted by nominalized predicates are not the universals that underlie the states of affairs that obtain in nature. Indeed, strictly speaking, they are not universals at all in the Aristotelian sense of having a predicable nature. Being an abstract entity is not the same as being a universal, in other words, and this applies in particular to the abstract objects that are denoted by nominalized predicates as abstract singular terms. Instead of being predicable entities, these objects belong only to the intensional order of our conceptual framework, where they provide an explanatory ground for the objects of pure mathematics, and perhaps also for the objects of fiction and the imagination. This means that intensional objects, as represented in a conceptualist theory of logical form, are on a par *as individuals* with the physical or concrete objects that are part of nature and that belong to the causal and spatio-temporal order of reality – except that, unlike the latter, intensional objects do not have any of the natural properties and relations that are the basis of predication in reality, i.e. of the states of affairs that obtain in nature. They are not also on a par with those same natural properties and relations, on the other hand, despite their also being called properties and relations (in the sense of the Platonist tradition, not in the sense of natural realism). This is because they do not really have a predicable nature in themselves, the way that the concepts whose intensional correlates they are do, but can only mimic such a nature (the way

that classes do in a theory of membership). They are, to be sure, constituents or components of propositions, where, by a proposition, as already noted, we mean the kind of intensional object that is denoted by a nominalized sentence as an abstract singular term. But because a proposition (which belongs to the intensional order) is not the same as a state of affairs (which is a part of the natural or causal order), Platonic forms, as intensional objects, do not occur in propositions the way that natural properties and relations do in states of affairs (viz. as the nexuses or modes of configuration of those states of affairs). Of course, just as some concepts will have a real property or relation corresponding to them in nature, so too some propositions will have a real state of affairs corresponding to them. Nevertheless, many propositions, such as those that make up pure mathematics as a body of knowledge, or those that make up the content of fictional stories and false theories, will have no states of affairs corresponding to them at all.

Not all forms of conceptualism will attempt to accommodate either a natural realism or an intensional realism as described above – though some form of natural realism would seem to be needed as a causal ground for concept-formation (just as some form of intensional realism would seem to be needed as an explanatory ground for the objects of pure mathematics, and perhaps also for the realms of fictional and intentional discourse). This is because, in keeping with the shift in emphasis from metaphysics to psychology, most modern forms of conceptualism are primarily concerned with giving a theoretical account of concept-formation as a psychological process. What, for example, are the psychological processes involved in learning a new concept that is not constructible from others already acquired, and are there any concepts that are innate and therefore not learned at all? These and similar questions make up the kinds of issues that most conceptualists are concerned with today.

As to the metaphysical issue of what it means for a concept to exist *in intellectu*, most modern forms of conceptualism reject the traditional view of concepts as images or ideas in the sense of particular mental occurrences and assume some sort of dispositional or functional view instead (cf. Price 1953, Chapter 8, for an account of the imagist theory, and Chapter 11 for an account of a dispositional theory). Peter Geach, for example, maintains that concepts 'are capacities exercised in judgement' (1957, p. 7), where the capacities are for intelligently using words and phrases in sentences, i.e. for knowing how to use the different expressions of a language to make up the sentences of that language. Wilfrid Sellars has described a similar view, except that, instead of identifying concepts with capacities regarding the use of expressions, he takes them to be the functional roles determined by those capacities; that is, concepts, according to Sellars, are the functional roles determined by the rule-governed use of linguistic expressions (cf. Sellars 1968, Chapters 3–5, and Sellars 1967, Chapters 9, 11, and 12). It is for this reason that Sellars also describes a concept as a 'linguistic type', and in particular a type that can be realized in different linguistic materials (the way, e.g., that the concept *father* can be realized in English by 'father', in German by 'Vater', and in French by 'père') in essentially the same sense in which the various pieces in the game of chess, such a the rook or the pawn, can be realized different kinds of material objects. In fact, functional roles, concepts, according t Sellars, are the rule-governed pieces of a conceptual system that can be described as the 'linguistic game' that is common to all of the languages of a given language family. It is this conceptual system, or 'linguistic game', that underlies predication in thought for the people who speak any of the languages belonging to that family.

In regard to the psychological mechanisms by which initial language acquisition and concept-formation are possible, Sellars, along with other conceptualists as well, maintains that, aside from innate discriminatory capacities, we need resort only to the stimulus-response reinforcement mechanisms of standard (behaviouristic) learning theory. This means not only that there are no innate concepts, but also that there is no innate categorial structure that is common to all conceptual systems, i.e. to all of the different

'language games' of all the different (biologically) possible language families. Such a universal categorial structure (which some conceptualists have assumed to exist as the basis of the *a priori* forms of human thought) cannot be explained on the basis of the stimulus-response reinforcement mechanisms of standard (behaviouristic) learning theory, in other words, but requires something more in the way of a biologically innate component of the human intellect.

Jerry Fodor has made a rather strong claim regarding such an innate component in his somewhat different functionalist account of the nature of thought. On this account, cognitive processes are computational processes of an internal representational system, which, because of its productivity and the way it functions, Fodor also describes as *the language of thought*. Concepts, according to Fodor, are the symbols (also called 'mental representations') of this inner language, i.e. the symbols that are 'tokened' in particular mental acts or inner processes of computation. These concepts, along with the categorial structure of the language of thought, are not learned by us on the basis of stimulus-response reinforcement mechanisms in the learning of a natural language. In fact, they are not learned at all but are innate, and, as such, they constitute the very framework by which we are able to learn our first natural language. Unlike Sellars's account of a conceptual system as a 'language game', in other words, the language of thought is not determined by public conventions and social conditioning but is instead the common basis upon which all natural languages are learned, and not just those belonging to a given language family. This means that the language of thought, because it is innate, is essentially (i.e. as a matter of biological necessity) the same for all humans.

Fodor also assumes what he calls a 'strict formality condition' regarding mental processes; namely, that we can have access only to the formal or syntactical operations that we can perform on the concepts that make up the symbols of the language of thought and none at all to their semantic properties (such as the property of being true, or of having referents and being about objects in the world). This means that mental states are to be given only an opaque (or *de dicto*) analysis in the language of thought and never a transparent (or *de re*) one, since the latter would involve a semantic notion of reference or aboutness (cf. Fodor, "Methodological solipsism considered as a research strategy in cognitive psychology", *The Behavioral and Brain Sciences*, 1980). An important consequence of this assumption is the rejection of any naturalistic account of the representational aspects of our concepts that attempts to connect them semantically with the world in terms of our causal interactions with the environment. This means that concept-formation is never a process in which 'new' concepts are learned; that is, any concept that we can learn and come to entertain in thought is innately determined by the representational power of the language of thought (cf. Fodor 1979, p. 95). It follows, accordingly, that the language of thought must be as powerful as any language that we can learn.

A naturalistic account of concept-formation in which the content or representational aspects of concepts are founded upon our causal interactions with the environment can reject this latter aspect of Fodor's theory without abandoning the idea that there is an innate component to concept-formation. A naturalistic account is not incompatible, in other words, with the assumption of an innate component that can provide a basis for the categorial structure of thought, and thereby of the *a priori* forms of thought and the principles by which new concepts are formed from others already acquired. Such an assumption need not take a form anything like Fodor's innate language of thought, and in particular it need not commit a naturalistic account to the existence of any innate concepts at all. That we are born without any innate concepts, John Locke pointed out in his *Essay on Human Understanding*, does not mean that we are born without any innate powers as well, which, in modern terms, we can assume to be powers that go beyond our innate discriminatory capacities and the stimulus-response reinforcement mechanisms of standard (behaviouristic) learning theory. Thus, even though there are no innate concepts in Jean Piaget's *genetic*

epistemology, there are innate powers, or mechanisms, by which the categorial structure and formal operations of thought can be constructed and by which new concepts that are semantically rooted in the world can be learned. One such power, for example, is a mechanism of autoregulation, which, as a result of our interaction with the environment, enables us to internalize certain structural features of the environment in the form of cognitive schemes. At first, in infancy, these cognitive schemes amount only to a form of sensorimotor intelligence; but in time, as a result of our ongoing interaction with the environment, they are reconstructed at successive stages of development into formal operations and more intensive schemes of cognitive organization. The constructive mechanism that is the basis of these successive stages of cognitive development is essentially the same innate power, which, according to Piaget, is driven by an equilibration process that moves us from states of lesser cognitive equilibrium (where our cognitive schemes are unable to explain certain aspects of the environment) to states of greater cognitive equilibrium (where new conceptual structures give us more explanatory powers). It is this constructive mechanism, in other words, that leads us on to ever more intensive cognitive organization, and ultimately to the formal categories and operations of thought of a mature adult (cf. Piaget 1977). Thus, according to Piaget, it is by means of an innate power (or mechanism of autoregulation) that we are able to learn concepts that are semantically rooted in the world, and it is by means of that same power (as a mechanism for equilibrating cognitive structures) that we are able to recombine successive stages of concept-formation and construct new conceptual systems that are logically more powerful than earlier ones.

Because of the way it allows for a pick-up of information and structure from the environment, such a naturalistic account can be taken as a component (in place of an archaic theory of abstraction) of one or another form of conceptual natural realism, which in turn can be taken as a modern version of an Aristotelian or an Abelardian theory of universals. With additional assumptions about the hereditary differentiations of the human brain that have come about through natural selection, it could even be developed into a kind of *biological Kantianism*, such as that described by Konrad Lorenz (cf. "Kant's doctrine of the *a priori* in the light of contemporary biology", in *Yearbook of the Society for General Systems Research*, 1962). Such an account is also compatible with a computational theory of mind, such as Fodor and others have described; and, perhaps, it is also compatible with the more modest kind of functionalist theory described by Sellars, but without the restriction to stimulus-response reinforcement mechanisms as the only means by which new concepts can be learned, and without the kind of nominalistic constraints or limits that Sellars is committed to in regard to the laws of compositionality for concept-formation (cf. Sellars 1967, Chapter 10).

All of these alternative versions of conceptual natural realism can be extended to include one or another version of intensional realism as well. But because intensional objects are represented in such a framework only as the correlates of concepts, what form such a system will take depends greatly on the logical structure of the laws of composition ality for concept-formation determined b the form of conceptualism in question. Two major types of conceptualism can be distinguished in this regard, one more restrictive than the other in the kind of principles that it allows for concept-formation. The first and more restrictive type is a *constructive conceptualism*, where, in accordance with the vicious circle principle of Russell and Jules Henri Poincaré (1854–1912), the logic is restricted to a ramified second order logic (with nominalized predicates as abstract singular terms when it is extended to include an account of intensional realism). The second and more liberal type is a *holistic conceptualism* in which the constraints of the vicious circle principle can be transcended (by means of a mechanism such as Piaget's innate equilibration process), thereby enabling us to justify impredicative concept-formation as well (such as is involved in the formation of the concept of a limit in mathematical analysis). Unlike the restricted logic of constructive conceptualism, in other words,

the logic of holistic conceptualism is an unrestricted impredicative second order logic (with nominalized predicates as abstract singular terms when it is extended to include an account of intensional realism). (Cf. Cocchiarella 1986, Chapter 2, and Cocchiarella 1988, as well as the article "Logic, higher order" in this Handbook for a more detailed account of constructive and holistic conceptualism.)

Conceptualism is by no means a monolithic theory, but has many forms, some more restrictive than others, depending on the mechanisms assumed as the basis for concept-formation. None of these forms, in themselves, precludes being combined with a realist theory, whether Aristotelian (as in conceptual natural realism) or Platonist (as in conceptual intensional realism), or both. Some conceptualists, such as Sellars, have made it a point to disassociate conceptualism from any form of realism regarding abstract entities, but that disassociation has nothing to do with conceptualism as a theory about the nature of predication in thought. Conceptualism's shift in emphasis from metaphysics to psychology, in other words, while important in determining what kind of theory is needed to explain predication in thought, should not be taken as justifying a restrictive form of conceptualism that precludes both a natural and an intensional realism.

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NINO B. COCCHIARELLA

Concursus Dei

From the 13th to the beginning of the 17th centuries there was developed a theory of a three-fold causality exerted by God over the world. To creation (*creatio*), there came to be added conservation (*conservatio*) and concurrence (*concursus*).

Christian philosophers had at first assumed that God exercised a sort of causality over the world which did not require another substance as subject of alteration: the *creatio ex nihilo*. As the spreading of Aristotelianism led gradually, however, to the calling into question of the ontological proof of the existence of God, they came to the view that the existence of God could be proved only cosmologically. Any theory of causality which corresponds to such a motivation has to distinguish between two kinds of causal chains. We might understand the causal relation K as a relation between an individual y and a fact $\phi(x)$, thus:

$$yK{:}\ \phi(x)$$

In case ϕ is the property $E!$ (of *existence*), then from the perspective of the old doctrine of *creatio* the proposition

$$yK{:}\ E!(x)$$

comes close to implying that y is God. Since Aristotle permits the generation of individuals, however, then one ought to be able to say that one material individual is the cause of another, that this is the cause of a third, and so on. In this way there is built up a causal *chain*. Since a man can survive his parents, an effect can exist even independently of its cause. Thus there are cases where:

$$(1)\quad yK{:}E!(x)\ \&\ \Diamond[E!(x)\ \&\ \neg E!(y)]$$

The Scholastics talk here of a contingent dependence (*subordinatio per accidens*) of x on y. A causal chain of the given sort can even

be infinite. If, however, we examine the usual cosmological proofs for the existence of God (for example at *Summa Theologiae* I, q. 2, a. 3; *Summa contra gentiles* I, c. 13), we find there a rejection of infinite causal chains. This requires for some x and y connected by chains of causality that:

(1′) $yK{:}E!(x) \rightarrow \neg \Diamond[E!(x) \,\&\, \neg E!(y)]$

When (1′) holds, the subordination of causes is then called *per se*. This order (1′) of cause and effect was seen for example in the illumination of a room by a source of light: the cause (the candle) has to exist and operate incessantly in order to warrant the duration of the effect (illumination).

In such cases of *subordinatio per se* a causal chain may have only a finite number of members and must be without cycles (think of the deduction of a formula in a finite number of steps). In this conception 'motion' has to be understood not as a change of place but in a broad sense as any sort of change. If at time t there holds $\neg\phi(c) \,\&\, \Diamond\, \phi(c)$, then one says that the object c at time t is in passive potency to ϕ. We can then write: $pot(c, \phi, t)$. Thus, for example, water is in passive potency to warmth. If an object b (e.g. a hot stone), is cause of the alteration of some c (e.g. water), then this object must itself possess actually the property ϕ (warmth). We can then write: $act(b, \phi, t)$. Motion is every transition from potentiality to actuality. Thus when, at some time t', the fact $\phi(c)$ is caused by b (here: the warmth of the water by the hot stone), then there must have existed a time $t < t'$ at which c is not yet ϕ but at which b actually possesses ϕ or some more intensive property. From this it follows that:

(IR) $\neg(xK{:}\phi(x))$

Causes of this sort are, in other words, irreflexive. There follows also a principle of transition (*quidquid movetur ab alio movetur*) which says that every change of an object occurs by virtue of the causality of *another* object. For times $t < t'$ there holds:

(TR) $\forall x[(pot(x, \phi, t) \,\&\, act(x, \phi, t')). \rightarrow \exists y\, yK{:}\phi(x)]$

If we consider the world *statically*, as something which merely continues to exist unchanged, then the Scholastics will say that the world's duration is a continuing alteration: the existence of an object c at a precise time t does not imply that c will also exist 1 second later. To exist at $t + 1$ is also a property c possesses only potentially at time t. If this is the case, however, then one should according to (TR) give a cause that conserves the existence of c throughout this time. This cause would be God and his action one of *conservatio* or *creatio continua*.

But the world is also *dynamic*. Finite objects can cause their own effects. For example, b causes that c becomes ϕ at time t':

(2) $bK{:}act(c, \phi, t')$

But the fact expressed by (2) may also count as a change of b itself, for there was a time t, at which b was not operating. The transition from *not operating* to *operating* is a transition from potentiality to act. For a time $t < t'$ the object b was in passive potency with respect to the causal property 'to make a ϕ of c at time t'':

(3) $pot(b, \lambda x[xK{:}act(c, \phi, t')], t)$.

Hence from (TR) and (IR) there follows:

(4) $\exists x[xK{:}(bK{:}act(c, \phi, t')) \,\&\, x \neq b]$

This produces a special sort of causal chain, in which it is the causation itself which is the property that is caused. Scholastics saw such a chain as being characterized by *subordinatio per se* (therefore it will be finite and not cyclical); further, they argued that there is exactly one object that causes all causations:

(5) $\exists! x\, \forall y,z[(x \neq y,z \,\&\, yK{:}\phi(z)x) \rightarrow xK{:}x\ (yK{:}\phi(z))]$

Perhaps one could even go further and argue with Spinoza (*Ethica* I, prop. 33) that if the fact that *God* $K{:}(aK{:}F(b))$, is itself contingent, then the causal chain should continue; this means that God's actions, too, must have some cause. The typical answer to this sort of argument however had been that the action of God is not performed within time or that it is identical with him. Spinoza's move is thereby blocked.

Concursus is that causality by which God collaborates in every other causality, be it act

or action. (For the initial formulation, cf. Thomas Aquinas, *Sum. Theol.* I, q. 105, a. 5; for the final version, cf. Francisco Suárez, *Disputationes Metaphysicae* XXII.) The *concursus* is then a synthesis of *creatio* and *conservatio* applied to the activity of things. If *b* causes something by its activity, God at the same time causes this activity (*concursus simultaneus*).

Apart from Durandus (*c.* 1275–1334) and his disciples, this *concursus simultaneus* had been accepted by all Scholastics. But already at this point certain problems arise. On the one hand the *concursus* is a decision (*decretum*) of God and – understood in this way – something which remains in God (*concursus ad intra*). On the other hand it is a concrete *effect* of God (*concursus ad extra*). But an effect is a finite being. How, then, could it cause a new genuine effect without a new *concursus*? In order to avoid this regress, the *concursus dei ad extra* was equated with the *actio* of the finite agent. But gradually the action of non-divine causes turned out to be a phantasmagoria, because such an action could not add anything to God's causation.

The question further arises why both the decision of God and that of the free human agent should coincide. The dilemma is: either God determines the agent or the agent determines God. In the first case human freedom is violated, in the latter the immutability of God is. The two positions in relation to this problem are: the *praemotio physica* introduced by Domingo Bañez (1528–1604), and the *scientia media* advocated by Luis de Molina (1535–1600).

The school of Bañez affirms a *concursus praevius*: God acts on the agent in order to make him perform an action. This explains the coincidence of decisions and divine knowledge of the future, but it makes freedom unintelligible.

The school of Molina follows an ingenious strategy: as the real free actions of men may not determine God, one searches for *doubles* of these actions that are no longer real. Every free action is associated with some conditional proposition. For example: 'If Petrus would be in circumstances A, then he would act in way C_i.' God, before his own decision, considers a set of disjunctions of the form

$$(6) \quad (A \rightarrow C_1) \vee \ldots \vee (A \rightarrow C_n)$$

where the C_i's are mutually incompatible.

Molina postulates that God knows in anticipation of the world's creation which conditionals will be false and which true if he creates this world. A conditional like

$$(7) \quad A \rightarrow C_k,$$

if true, is called a *futuribile*. God's knowledge of (7) is called *scientia media*. On the base of this knowledge, God decides, if A occurs, to give the *concursus simultaneus* for the action which is described by C_k. Therefore God's decision is determined by his knowledge of (7), not by the real agent.

This theory, however, raises several questions. Can a proposition like (7) be timelessly true? Does it determine God causally? Does its truth not render impossible the freedom of the action C_k describes?

The discussions about *concursus* took on institutional dimensions when the quarrel between Jesuits and Dominicans brought the Church to the very edge of schism. At the same time, these discussions carried scholastic philosophy *ad absurdum*: Aristotelian speculations about finite objects, already shaken by the new developments in physics, could not be transferred to the God needed by theology. This quarrel left its traces in the subsequent development of philosophy. Once the concept of causality had come to seem obscure, there arose Spinozism, occasionalism, and the doctrine of pre-established harmony. The opposition between causality and freedom survived Scholasticism and rationalism and has since been often formulated (for example in Christian A. Crusius, Kant, and Arthur Schopenhauer) as the question whether the principle of sufficient reason is compatible with freedom.

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Conrad-Martius, Hedwig

Hedwig Conrad-Martius was born in Berlin in 1888 and died in Munich in 1966. She studied in Rostock, Freiburg, Munich, and Göttingen and came to metaphysics via a phenomenological criticism of positivism, incited especially by Edmund Husserl, Adolf Reinach, Max Scheler (1874–1928), and, later on, also by Martin Heidegger.

In her treatises *Realontologie* (1924) and *Das Sein* (1957), she developed the outlines of a universal ontology as an eidetic science or '*Wesenswissenschaft*':

> We immediately and naïvely combine with an entire world the consciousness of its being real; thus we have only to explicate what for us is implied with necessity in this consciousness (1924).

Phenomenology hereby provides the proper method of ontology, since: "The question of the essence of real being is the fundamental problem of ontology" (1957).

From this perspective there opens up an eidetic outlook upon absolute being. Metaphysics refers, however, not to the essence of absolute being, but to absolute being conceived as a matter of fact. The recognition of what Conrad-Martius calls 'transempirical areas', intermediate between the levels of empirical and purely metaphysical competence, is perhaps her most original achievement. Setting out from certain results of modern science and phenomenological investigation, she seeks to establish in a new way the idea of a philosophical cosmology. Here the following works are of importance: *Der Selbstaufbau der Natur* (2nd ed., 1961), *Naturwissenschaftlich-metaphysische Perspektiven* (1948), *Die Zeit* (1954), *Der Raum* (1958), and *Schriften zur Philosophie I–III* (1963–5).

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EBERHARD AVÉ-LALLEMANT

Content, Narrow

The notion of content is one primarily associated with sentences. The content of a sentence 's' is the meaning of 's'. Derivatively, content can be attributed to (certain sorts of) mental states. If Jones has a belief that water is wet, then the content of his belief is simply the meaning of the sentence 'Water is wet'.

Recently, much attention has been directed to the question of whether a scientific psychology ought to employ explanations which relate mental states in virtue of their contents. It has been claimed that mental contents are radically unsuited to playing such a role. The primary source for such a claim is what we might call the '*Doppelgänger* Challenge' (Putnam 1975, Burge 1979).

$Jones_1$ lives on Earth. Among the multitude of his mental states is the belief that water is wet. $Jones_1$ has a counterpart – $Jones_2$ – living on a counterpart earth – Twin Earth. Suppose $Jones_1$ and $Jones_2$ are physically identical down to the level of molecular structure. Twin Earth is exactly the same as Earth except for one thing: there is no water on Twin Earth. Instead there is a substance which looks, feels, tastes, etc. exactly the same as water, which, indeed, is denoted by the expression 'water', but which has a different underlying structure – for example, XYZ as opposed to H_2O. Call this other substance 'retaw'.

The crucial point is that $Jones_2$ never has a thought about water. Throughout his life he has never been in contact with water, only with retaw. The moral is this: what mental states one has depends not just on what is inside one's head – the Joneses are identical twins – but also on what is outside it. The thought of $Jones_1$, attributable by a sentence of the form 'Water is wet', and the thought of $Jones_2$, attributable by a sentence of the same phonetic form, differ because water is an essential constituent of the former, and retaw is an essential constituent of the latter.

Despite this divergence, the two thoughts play an identical role in the production of behaviour. *Ex hypothesi*, the belief of $Jones_1$ causes him to interact with water in precisely the same way that the belief of $Jones_2$ causes him to interact with retaw. We say that the

two beliefs are identical in point of *causal power*.

This argument, if correct, shows that classification of thoughts by content does not coincide with classification of thoughts by causal power. But, it is argued, since a scientific psychology will seek to develop causal explanations of behaviour, and hence will subsume mental states by way of their causal powers, the classification of mental states required by this psychology will be one based around causal power, *ipso facto*, not around content.

The search for *narrow content* is the search for a scientifically utilizable form of content; the search for a category of content which *is* taxonomized according to causal power. The category of content is dubbed 'narrow' because it is envisaged that it will be constituted solely by what is in the head of the relevant organism. The primary strategy, in recent literature, has been to find a collection of contents which are, supposedly, genuinely narrow, and to construct all other contents out of these. These base narrow contents are generally regarded as *phenomenal* in character. Returning to the *Doppelgänger* case, it could be argued that the beliefs of Jones_1 and Jones_2 are identical in point of causal power, hence identical in point of narrow content, because both water and retaw have associated with them the same phenomenal properties: being colourless, being odourless, etc. This has led to the claim that narrow content can be expressed in terms of phenomenal concepts. According to this view, then, the narrow content of the thought that water is wet would be expressed by the sentence, "The colourless, odourless, drinkable, . . . liquid is wet" (Dennett 1982).

This strategy has been criticized by Burge (1979, 1986). Burge argues that cases similar to the *Doppelgänger* described by Hilary Putnam can be constructed for *all* contents; hence, not even phenomenal contents are narrow. This is tantamount to the claim that there is no category of content which respects causal power taxonomization. Burge's arguments have led to a split in recent philosophy of psychology. On the one hand there are those who reject the use of content altogether in psychological explanation (Stich 1983). On the other there are those who argue that causal power classification of a mental state is not necessary for that state to figure in the explanations of psychology (Burge 1986).

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MARK ROWLANDS

Contingentism

As a result of the general contempt for logic which was prevalent in French philosophy after René Descartes and Etienne Bonnot de Condillac (1715–80), 19th-century French philosophers paid little or no attention to the logical notions of necessity, possibility, and contingency. These modal concepts were, however, widely discussed outside logic in the context of a dispute between necessitarianism, the doctrine that nature and mind are determined by their essence or by a general law, and contingentism, the idea that nature is not completely determined by such essences and laws, but contains an irreducible element of the unpredictable, i.e. of freedom. The main question for contingentism was: how can we reconcile necessity and contingency?

Physical determinism, the thesis that nature is subject to universal deterministic laws, was widely held to be the most exemplary expression of necessitarianism, and it was discussed mainly by scientists and philosophers of science. Here Pierre Simon de Laplace (1749–1827) is of particular importance. His famous 'demon', the idea of a superior intelligence which would comprehend all the causes which necessitate events,

is very often considered as the paradigm of determinism in this sense. But Laplace does not posit determinism as an ontological doctrine about the nature of things: it is a 'limit idea', designed to help us to understand what a completely deterministic world *would be like*. Laplace and his followers discuss the modal notions of necessity and possibility in the context of the theory of probability. Although Laplace understood necessity and possibility as properties of real events, as *de re* modal notions, they are for him epistemic in nature in that they are measured by our probability calculations, and are therefore relative to our knowledge or ignorance of natural laws. The positivism of Auguste Comte (1798–1857), in contrast, rejects probabilistic laws, and confines necessity to laws about observables.

The most interesting attempt to reconcile determinism and contingency is made by Augustin Cournot (1801–77). Cournot takes probability as an objective measure of possibility in nature ('physical' possibility) and accepts determinism about natural events (*Essais sur les fondements de nos connaissances*, 1851). But he admits that randomness, defined as what ensues when independent causal series meet, is an objective feature of nature. Chance permeates the universe, from physics to biology and even mathematics.

Modal notions were also discussed in the context of traditional metaphysical ideas. As Hintikka (1981) has shown, a useful tool for sorting out ideas about modality is provided by Arthur Lovejoy's 'Principle of Plenitude', according to which no genuine possibility remains for ever unrealized. Although the idea of a Great Chain of Being disappeared progressively in the domain of natural history and of biology, it nevertheless resurfaced in Félix Ravaisson's (1813–1900) analysis of habit as a realization of possibilities, an analysis which was later to inspire Henri Bergson (1859–1941).

Most contingentists, however, rejected the Principle of Plenitude. Charles Renouvier (1815–1903), in his *Essais de critique générale* (1854–97) expounds a so-called 'neo-criticism', and gives a Kantian analysis of modalities as features of our representations. He also discusses modal concepts with reference to the problem of future contingents. The antinomy between determinism and freedom is according to him a special case of the opposition between 'infinitism', according to which nature contains an infinite number of things and has no finite origin, and the opposite doctrine of 'finitism'. If the will is free, one needs to postulate 'absolute beginnings' in the world, events which are not determined by any cause. But this principle of contingency has no ontological import: it does not postulate an essence of things, but only a law of our representations. It is 'regulative' in the Kantian sense.

Emile Boutroux (1845–1921) (see his *De la contingence des lois de la nature*, 1874), on the contrary, takes contingency as an objective feature of the world, conceived as a hierarchy of forms of increasing complexity. Such 'necessity' as exists at the lowest, physical level of the universe is already pervaded by the contingency which rules the topmost level of organization, life, and intelligence. All the laws of nature are contingent, which implies that at least some possibilities can remain unrealized. Necessity is relative to a level of organization, and is not absolute.

Bergson followed his predecessors in admitting also a form of contingentism: nature and being are not predetermined, and freedom lies at the bottom of being. But his contingentism does not rest upon the notion of possibility. Possibility, for Bergson, is a mere projection of our minds on to the nature of things: it is a psychological notion. There are no unactualized possibles, because every being is either actual, or 'virtually' actual, but never merely possible. Duration, which is the true essence of time, is both something we experience and a property of the world. It is the actualization of 'virtualities' already contained in nature, especially in the living world. This is a form of the Principle of Plenitude, but it is atypical, since this actualization of virtualities by the *élan vital* is not an actualization of pre-existent possibles.

Contingentism is therefore a doctrine which took many forms. Its distinguishing feature is that it was part of an attempt to build a philosophy of nature. In the 20th century, most French philosophers have abandoned this attempt.

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PASCAL ENGEL

Continuity

In Book V of his *Physics*, Aristotle gives an analysis of *continuity*, to which one must refer in accounting for what follows. He characterizes the *continuous* (συνεχής) as a particular case of the *contiguous* (ἐχόμενον), which is itself a particular case of the *consecutive* (ἐφεξῆς): *consecutive* terms are terms of a series separated by no intermediate terms of the same kind; *contiguous* terms are terms which are in contact with each other; *continuous* terms, lastly, are terms which are such that the boundaries at which they are in contact are one and the same. In order to illustrate this distinction, Aristotle borrows his main examples from physics; nevertheless his distinction can be applied also to the only two sets of mathematical entities which the Greeks recognized at that time: *numbers*, i.e. the natural integers, and *magnitudes*. Numbers, whose theory is developed in Books VII, VIII, and IX of Euclid's *Elements*, are only *consecutive*: magnitudes, in contrast, whose theory is explained in Book V of the *Elements*, are *continuous*. It was impossible for Aristotle to illustrate the contiguous by a specific mathematical entity: in mathematics, as Averroes (1126–98) will notice, every contiguous term is already continuous.

Richard Dedekind (1831–1916) does not depart from the Aristotelian definition when he characterizes, in relation to the particular case of the straight line, what he calls *the essence of continuity* (*das Wesen der Stetigkeit*) as follows:

> If all points of the straight line are divided into two classes, so that every point of the first class is on the left of every point of the second class, then there is one, and only one point, which makes this division of all points into two classes, this splitting of the straight line into two pieces.

This definition and that of Aristotle differ only in respect of their underlying grammatical conventions. Aristotle, and the whole scholastic tradition after him, felt no repugnance in attributing to each of two continuous parts the element constituting their boundary or limit. In the modern vocabulary of set theory, in contrast, it is stipulated that the limiting point is to be attributed only to one of the two subsets involved. A non-discrete linear series is called *continuous* if, given any division of this series which determines two subsets, either the one has a first element or the other has a last, it being excluded that this element could belong to both.

The non-existence, in Greek mathematics, of any kind of entity intermediate between *integers* (that which Greeks called *numbers*) and *positive real numbers* (that which Greeks called *magnitudes*), had hindered Aristotle, in spite of the excellence of his definition, from distinguishing *continuity* and *density*. This explains the confusion of the two notions up until the 19th century. Only then does the set of the rationals, taken in itself, serve as the indispensable counterexample of a dense but not continuous set.

If we compare the infinity of the rational points of any linear segment with the infinity of all points, rational or irrational, of the same segment, then we must acknowledge that the first is included in the second, while the second is not included in the first. When Georg Cantor shows that it is possible to find a one–one relation between the first set and the infinite set of the integers and when he proves, by his diagonal argument, that such a relation is not possible for the second set, then he establishes thereby the singularity of the cardinality of the continuum. This singularity had hitherto been only surmised by a few late scholastics such as the Jesuits of Coimbra or Eustace of St. Paul (1573–1640).

Once the superiority of the cardinality of the continuum over that of the set of natural integers is recognized, there arises what is called the *continuum hypothesis*: the conjec-

ture that there is no cardinality intermediate between the two. In 1938 Kurt Gödel demonstrates that this hypothesis is formally consistent with the axioms of the most commonly accepted system (Zermelo-Fraenkel-Skolem) of set theory. In 1963, Paul Cohen establishes in addition that the negation of this hypothesis is also consistent with this system.

This *independence* of the continuum hypothesis can be diversely interpreted: shall we conclude that the hypothesis is neither true nor false, or merely that we never shall be able to prove its truth or falsehood? Or must we have recourse to other axiom systems, in which Gödel's and Cohen's results do not hold? Does this independence only signify that the Zermelo-Fraenkel-Skolem system is not sufficient to ground a suitable ontology, and will the adoption of a new axiomatic basis allow us one day to solve the continuum problem?

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JEAN-LOUIS GARDIES

Conventionalism. See: Semantic Conventionalism

Copula

It is a commonplace that the verb 'is' can express such diverse relations as identity, the membership relation and the relation of inclusion between classes. If this verb is employed as a sign of predication, it is called the *copula*.

It is a question that belongs mainly to the philosophy of logic whether the copula divides every elementary proposition into subject and predicate and whether such an analysis is in every case adequate. From an ontological point of view, however, it is interesting to see how different conceptions of the role of the copula involve a commitment to different sorts of entities and structures: since every verb can be split into copula and predicate, some philosophers considered this as a signal for a special ontological position or status of what they called 'being'. Furthermore, because the copula is a special relation, its assimilation either to the subject or to the predicate was taken as a signal for one or other partition of entities in general.

Copula and Being. In Boethius, Thomas Aquinas, and Thomas of Erfurt (perhaps also in Martin Heidegger, who commented on Thomas of Erfurt in his habilitation), entities are classified according to whether names for them may or may not occur grammatically to the left of the copula. If the predication '*A* is *F*' can be true only if *A* exists, then it seems reasonable to permit also a sentence like '*A* is' where the copula occurs as predicate. This '*A* is' cannot, however, be affirmed if *A* is substituted by a verb. Considering this case not as a pure matter of grammar, the idea suggests itself that being is not, or is *no thing (esse non est)*. If one wants to see in 'being' something more than a substantivization of a verb, for example the reason why an entity has the property expressed by '. . . is', then one should introduce an ontological difference between being and thing *(Sein* and *Seiendes)*.

Copula and Function. Even less daring analyses may lead to bizarre ontological commitments, as for example those incurred by Gottlob Frege. If the copula is considered as part of the predicate, then expressions like:

(1) *a* (*is* φ)

sanction the idea that predication is only possible if there are two categories of entities: objects and functions. Just as, for Boethius, 'is' is not predicable of being without making of being an entity, so for Frege it should analogously not be possible to say of two functions that they are identical or different, for this would convert them into objects. Frege, accordingly, needs to introduce special objects which 'represent' his functions.

Copula as Relation to the Absolute. In F. H. Bradley and in the early writings of G. E. Moore there appears a division of conceptual content and of the copula along the lines of:

(2) $(a\ \phi)$ *is*,

such that every proposition expresses both a composition and an exemplification of properties. Thus (2) affirms that the properties *to be a* and *to be* ϕ are together exemplified in reality. Is the predication 'is', here, to be regarded as an ontological relation R between entities a and ϕ? If so, then one could now go on to ask for a new relation R' between R and ϕ, and so on in vicious regress. Bradley is led by these means to conceive predication – or the copula – as a relation between thought and the one single reality which he calls the Absolute and which serves as the subject of every judgement. Every true sentence says how the world is, so that (2) has more properly the form:

(3) *The absolute is* $(a\phi)$.

Copula and Identity. What is the meaning of 'is' when it occurs between two singular terms, as in 'Aristotle is the author of the first five books of the *Metaphysics*'? Does the copula here express an identity, or some other equivalence relation between two non-identical objects? Philosophers who plead for the latter can avoid the usual paradoxes of opaque contexts: if John believes that Aristotle is Aristotle, but does not believe that Aristotle is the author of the first five books of the *Metaphysics*, then one can say that the name and the description refer to two non-identical entities which are in some strong relation of coincidence. On the other hand, however, in order to explain this relation, such philosophers have to introduce an ontologically complex assortment of new individuals: individual accidents, moments, guises, mereological structures, and so on.

Diverse Kinds of Copula. The Scholastics wondered whether sentences like 'Caesar is Caesar' or 'Men are human beings' would remain equally true even if there existed no human beings at all. William of Sherwood (*c.* 1200/10–*c.* 1266/71) distinguishes between an *esse actualis* and an *esse habitualis* and discusses antinomies such as the following: "Suppose that there is nothing. Then it is true that there is nothing. Hence there is something true. Hence there is something. Therefore, if there is nothing, there is something." Another important puzzle that stimulated the later discussions about the distinction between essence and existence was the fact that some predications (like Kant's analytical judgements) may be true without there being anything to which their terms refer.

These considerations have nowadays a slightly different tinge. Henry Siggins Leonard observed against Bertrand Russell that $\forall x\,(x = x)$ is a logical truth, while $(\exists x)\,(x = x)$ is a metaphysical one. This observation supports the idea of a free logic. One may ask also whether there are *two kinds of predication*, one internal and one external, the former not demanding existence of the entities to which predicates are seemingly applied. In the same way one could think that in:

(4) Unicorns are animals with single horns,

the copula indicates that the property expressed by the predicate is included in the essential properties of the subject. In:

(5) Unicorns are fictitious animals,

in contrast, the copula expresses a property which is alien to the subject. It is important to observe that the internal copula of (4) cannot be expressed via the universal quantification of a conditional, since this would imply also that

(6) Unicorns are centaurs

would be true: for every x it is false that x is a unicorn, hence the conditional reading of (6) is true. Even an analysis of (4) which adds a modalization would not be helpful here, since then:

(7) Every *perpetuum mobile* is a round square

would also be true.

An alternative to the account of two types of copula appears in the modern reconstructions of Alexius Meinong's *Gegenstandstheorie*. Neo-Meinongians like Richard Routley and Terence Parsons interpret the copula as functional application, thereby identifying individuals with sets of properties. Thus in:

(8) $[\lambda P\,(P\,(a))]\,\phi$,

the copula is absorbed into the subject in such a way that '*a* is ϕ' says that the property ϕ has the property of *being a property belonging to a*. They distinguish thereby between nuclear properties like 'being round', 'being square', or 'being existent'; and extranuclear ones like 'exists', 'is possible', 'is thought of', etc. In this way one can easily accept *the round existing square* as an object, without falling into the well-known contradictions. On this approach the distinction between an internal and an external copula is transferred to the properties themselves.

It remains unresolved, however, whether the above-mentioned theories could cope with paradoxes like those of Kōnig or Berry. The least number that cannot be specified without using more than eighty symbols seems, here, to have been specified without using more than eighty symbols. Theories of the copula and of predication would receive a decisive confirmation if the distinction between internal and external copulas could resolve such difficulties independently of introducing levels of language.

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CARLOS A. DUFOUR

Cornelius, Hans

Hans Cornelius (1863–1947) studied music, philosophy, mathematics, and history of art, and obtained a doctorate in chemistry (Munich, 1886) and a habilitation in philosophy (1894). He held professorial positions at the Universities of Munich (1903–10) and Frankfurt. His main works deal with aesthetics and theory of knowledge, for both of which he tried to find a sound psychological foundation. His use of Gestalt concepts and accurate descriptions contains interesting contributions to naïve ontology. In particular, he argued that attention can modify the sensory content of perception by producing different forms of figure-ground configurations (e.g., when analysing a complex tonal structure we select a sound by pushing other sounds into the background). Moreover, he stressed the importance of temporal Gestalten, which play a fundamental role in the explication of the phenomena of expectation.

Gestalt qualities, Cornelius argues, are required as properties of complexes in order to explain the similarity among the latter in the absence of similarity of their constituent parts. However, they have no existence on their own, and can in the final analysis be reduced to similarity classes (1900, pp. 101–2; 1923, p. 232).

There are two kinds of complexity: we can recognize either a plurality of contents having existential independence and capable of existing when separated from their environment; or a plurality of characteristics (*Merkmale*) of a content, which lack independence – as, for instance, the pitch, intensity, and timbre of a sound.

Cornelius's metaphysical position is phenomenalist: things in themselves, which he identifies with common-sense things, are but *rules* for their appearances (1897, Chapter 5). He maintains, however, that things cannot be reduced to their appearances.

Cornelius's psychological analyses (which he describes as 'pure phenomenology') lead him to state that the tendency to unification is the fundamental principle of psychical life. This tendency appears in various forms of

symbolization (mnestic, imaginative, conceptual, linguistic). It seems that Cornelius meant by 'symbol' a sort of vague representative idea (*Vorstellung*). On this point Edmund Husserl criticized him severely in his *Second Logical Investigation* (§39, Appendix), by remarking that Cornelius confused the generality of concepts with the vagueness of memory images, and thus merely reproduced a psychologistic version of the Lockean theory of concepts. Of some importance is the fact that, in expounding his theory of concept, Cornelius pointed to the necessity of a deictical or ostensive determination (*deiktische Bestimmung*) of non-definable concepts, at the same time refusing to consider this as a causal origin of the elementary concepts themselves (1903, p. 94).

Cornelius's aesthetics is mainly an enquiry into the necessary configurational conditions of valuable works of art, and constitutes an application of Gestalt principles to the study of these. His investigations cover a wide range of modes of representation of objects, volumes, rhythms, and movements.

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ROBERTO CASATI

Cosmology I: Metaphysics

Introduction. Cosmology and philosophy share much the same history. They begin together in the questions of Thales (fl. *c.* 580BC), Anaximander (*c.* 610–*c.* 547/6), Empedocles (*c.* 490–430BC), and the other pre-Socratics as to the nature of the universe and of its objects. Yet the two disciplines are not identical; their conceptual elements are interwoven, but still distinguishable.

Unlike the cosmology of the pre-Socratic period, or the cosmology of moderns such as Leibniz, Newton, and Kant, contemporary cosmology, which is our object here, is grounded thoroughly in empirical natural science. This alters and sharpens the character of the interaction between philosophy and cosmology.

Examination of cosmological theorizing reveals two broad classes of metaphysical problems. The first resembles nothing so much as the sort of problems one finds in general philosophy of science relating to the interaction between metaphysics and method – for example, issues relating to the uses of principles such as simplicity in model construction. A second set of problems bears strong connections to classical problems in metaphysics, for example, creation, the chain of being, design, and man's role in the universe. We shall deal with each of these in turn.

Philosophy of Cosmological Science. Exactly like other natural sciences, cosmology involves theory and observation. Yet, unlike other sciences, theory in cosmology is much richer than observation. Hence, several theories usually compete to explain the same data. Moreover, observation typically involves subtle interpretations based upon long chains of extrapolation from the laboratory environment. Finally, methods and types of observation change but slowly. These factors combine to produce a unique historical path for the conceptual evolution of cosmology: a punctuated-equilibrium trajectory of long periods of stagnation interrupted by short periods of rapid and often drastic change.

Metaphysical principles play a major role in this conceptual evolution. Extremely general, unverifiable principles are used both to guide research and, especially, to function as decision criteria for choices between competing theoretical world-pictures. The essential methodological point here is: when observations are not available to decide between competing theories, cosmologists

typically base their decisions instead upon metaphysical principles. Hence, principles such as the Copernican Principle ('the earth is in no special position in space-time'), the Cosmological Principle ('the earth is in a typical position in the universe'), and more well-known principles such as Simplicity, Richness, and the Unity of Nature, permeate cosmological thinking.

Most cosmologists accept the notion that the use of metaphysical principles such as these is intrinsic to cosmology as a science.

A further metaphysical difficulty intrinsic to cosmological science involves its object. It is not clear exactly how to answer the question 'What is the science of cosmology *about*?', since the universe as an individual object can hardly be given to us, no matter what theory of reference we might care to adopt.

Philosophers and scientists such as Milton K. Munitz and E. A. Milne (1896–1950) have suggested that 'the universe' actually means 'the observable universe', that is, the region of the physical universe whose electromagnetic emissions we can detect. Although this move might seem to solve several problems, it raises others, of a peculiarly scientific nature.

A first difficulty arises from the Special Theory of Relativity, according to which electro-magnetic radiation has a finite velocity. Accordingly, some regions of the universe which, presumably, are not presently observable, will become so in the future. Does this imply that these regions are not now part of the universe, but will become so later on?

A second difficulty, noted by Sir William McCrea, arises from the General Theory of Relativity, which is as it stands a global theory; that is, it is a theory about a single object, and about its properties *qua object*. Hence, this theory treats the universe as a whole, and is not limited to the observable universe.

Cosmological Metaphysics. The recent union of particle physics and cosmology has generated techniques powerful enough to investigate the instant of cosmic creation itself. Indeed, some quantum theoretical concepts suggest mechanisms by which the universe may have come into existence, e.g., as a vacuum fluctuation event, or as a quantum tunnelling event from another universe. It is evident that many contemporary cosmologists feel no hesitation in the face of ultimate questions concerning the origin of the universe.

Another area of research involves the question 'How many universes are there?', a contemporary analogue of traditional concerns with the so-called Great Chain of Being. Both adopt the principle that 'Being is as rich as possible', and then proceed to investigate the ramifications of this assumption. Today's quest, however, employs the methods and techniques of cosmology, particle physics, and quantum theory to illuminate niches in which alternative universes might dwell. Hugh Everett, Bryce DeWitt, and Brandon Carter have proposed cosmological models, the so-called 'Many-Worlds' schemes, which produce multiple branching universes via rigorous realistic interpretation of the initial quantum probabilistic solution to the relativistic equation for the universe. B. Sato, A. D. Linde, and others have investigated versions of the 'daughter universe' scheme, in which complete universes generate other complete universes as offspring – the latter then generating 'granddaughter universes', and so on *ad infinitum*.

A third group of research concerns the consequences for the universe of the existence of mankind. This programme, called the 'Anthropic Principle' programme, considers, for example, the idea, first proposed by John Wheeler, that, when coupled to the quantum principle 'only the observed is real', the existence of human observers in some sense generates the real universe.

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Cosmology II: The Reasons for the Cosmos

One of the outstanding features of the physical sciences at present is the recent shift of the old question: 'Why is there something rather than nothing?' from the area of metaphysics to the rational framework of scientific investigation. This situation results from the unexpected interrelation between two *a priori* distinct facets of reality as described by contemporary physics: on the one hand, those described by Albert Einstein's General Theory of Relativity, which unveils the nature of gravitation; and, on the other hand, those described by quantum theory, which provides a description of the microscopical world at the level of the elementary constituents of matter.

In fact, we are at present witnessing a fascinating new situation in physics wherein any improvement in our perception of the universe leads directly to wholesale returns in our understanding of the fundamental interactions of the elementary particle world, and *vice versa*. This represents an alternative to the old dream of the unification of all types of interactions in nature as different facets of a single unique proto-force.

This main novel situation is that a definite history can be ascribed to the universe, an origin as well as a systematic sequence of events occurring as time elapses. This history is a genuine one, and not the elucidation of some conceptual *a priori* mathematical model which had come out of the relativistic equations of Einstein's theory in a purely speculative manner.

The fact that physicists are able to situate the origin of the universe in time at fifteen thousand million years ago is not the outcome of a rationally organized research programme but a consequence of two events, which were as uncalled for and unexpected as was the discovery by Sir Isaac Newton of gravity. These two events were, first, the discovery by Edwin Powell Hubble (1889–1953) of the recession of the galaxies, which gave rise to the notion of an evolving universe; and, second, the famous measurement of the fossile radiation of 2.7°K (about −270°C), which gave this evolution an origin in time, that is to say gave the universe a definite age. The notion of a physical history of the universe thereby replaced, much to the surprise of physicists, the mathematical models which had come out of Einstein's equations in a purely speculative manner.

General relativity removes explanation in terms of force, and interprets gravitational motion as free motion along preferred trajectories, the 'geodesics' of space-time. In other words, the existence of the gravitational force, which is an *a priori* of the Newtonian universe, is replaced by an intrinsic property of space-time. The latter is no longer taken to be an inert receptacle, but responds with its curvature to the presence of matter. The *cosmological* model of Einstein took this matter content to be a homogeneous continuum; as it turns out, however, it is precisely this homogeneity which breaks up the relationship between cosmic order and gravitation which general relativity set out to realize. In the solar system, the motion of the planets maintains its equilibrium. But in a homogeneous and isotropic medium, under the influence of gravitation alone, there is nothing to counteract its self-amplifying tendencies. In fact, gravitation increases the density of the medium, which in turn increases the intensity of gravitation, and so on.

The rest of the story is well known. The 'natural' solutions (Friedmann-Lemaître) of the cosmological equations of Einstein are evolutionary. Either the universe is in permanent self-enhancing collapse, or, contrariwise, it exists in permanent expansion slowed down by gravitation, and exists due to a primordial event (the explosion of an original atom, according to Lemaître), which imparted initial velocities to its constituent parts. Hubble's discovery, in a quite unexpected and dramatic way, confirmed the physical reality of the Friedmann-Lemaître evolutionary model. At the same time, however, it left physicists with the peculiar problem of the initial event which allows our universe to escape gravitational collapse, whether for a while or for ever, depending on the density of its matter content.

At the Big Bang, all quantities appertaining to the Einsteinian universe–curvature, density, pressure, rate of expansion, temper-

ature, etc. – are infinite. Among these, we included temperature. But what does temperature signify in a purely gravitational universe? There is actually no rigorous definition of temperature for that case. What it represents is the *thermodynamic* description which cosmologists have grafted on to the gravitational description of the expanding universe. The expansion, being adiabatic, should conserve the entropy of the universe, which implies that temperature T decreases as the 'radius' R of the universe increases (RT is constant). This temperature 'put in by hand' becomes the true physical measure of the time which accompanies the expansion of the universe. Strictly speaking, the expansion consists of an increasing separation of the galaxies, but it is to the cooling of the whole that physicists attribute the progressive appearance of the various categories of particles and forces which have been identified in the present universe.

Any beginning must have its actors. These, by definition, are heterogeneous, and their various interrelationships weave out a history. However, this does not usually mean that, governing the succession of events, there is a single reason from which the history can be deduced; and so it is with the 'Standard Model', generally accepted until recently. There gravitation appears as the primordial actor, but physicists have introduced other protagonists, whose history, although ruled by the expansion of the universe, obeys other governing reasons. Gravitational expansion, with thermodynamic-type cooling incorporated, creates a history in which quite different types of events succeed each other: decouplings, symmetry breakings, and differentiations.

However, must this physical *history* necessarily have as its origin an *unphysical event*? Is it possible to imagine the beginning of history in another way, to have the matter content of the universe be 'born smoothly', thereby avoiding the necessity of an initial singularity?

Several years ago, a model was devised, whose predictive consequences and implications have since been further developed. This model enables one to substitute a real history in place of the reasons of the Standard Model, namely the history of the genesis of our material universe. In the beginning was the vacuum, but not the 'Nothing' which Henri Bergson rightly criticized as artificial thought *par excellence*, that which 'remains' when everything has been removed. The vacuum, in the sense of contemporary quantum physics, manifests itself by a perpetual rustling of sparkling occurrences of all the possibles of which it is the infinite reservoir. At every instant, at every point, pairs of virtual particles appear and vanish in the time of an uncertainty, unless they are provided with the means to be converted to real particles, namely the energy corresponding to their mass.

The quantum vacuum is a strange actor, indeed. It is potentially capable of everything, but cannot by itself generate anything. Any actual measurable effect needs an external source of energy. How then can it be the principle for the origin of the universe which is *by definition with no outside*? How can one conceive, within an 'empty' universe, the existence of an energy source which realizes the constituents of our universe?

In the beginning was the quantum vacuum but *also* the gravitational field. This dualism expresses the fact, which we have already stressed, that the gravitational force resists to this very day all conceivable attempts at unification. We are obliged, therefore, in the present state of theory, to dissociate it in the quantum vacuum from the other three forces of interaction. Now it is this dualism, whether inherent or not, which constitutes our point of departure.

In fact, one of the main difficulties standing in the way of unification stems from the fact that the three 'quantum' forces always manifest themselves by virtue of the existence of carriers of opposite qualities. These carriers can, therefore, form neutral composites which are insensitive to the corresponding interaction. Thus, for example, there exist electrically neutral entities, in particular molecules. In the same way, any entity of zero hadronic number (that is zero 'charge' for the strong interaction) is insensitive to the strong interaction, and every entity of zero leptonic number (zero weak 'charge') is insensitive to the weak interaction. However, *no entity*

whatsoever is insensitive to gravity. Gravity has a unique and universal effect of attraction (in its Einsteinian interpretation in terms of curvature).

Therefore, whereas the pairs of virtual particles which appear out of the vacuum can be insensitive to the other three forces (depending on whether they are of zero charge, zero hadronic number, or zero leptonic number), *they are always sensitive to gravitation*. The following question then arises. If a pair of virtual particles appears in the empty universe, what mutual effects exist between them and the gravitational field?

The question can be put in another way. In the beginning were two empty infinite reservoirs, the reservoir of possibles which constitutes the quantum vacuum, and the reservoir of energy, which constitutes the curvature of space-time. In fact, the more space-time is curved, the more the energy which characterizes it appears to be *negative*. The question is then: can the physically conceivable mechanism of the creation of matter '*ex nihilo*' be actually put into action? Can the two reservoirs be put into communication in a way that brings virtual particles into existence with an energy supplied by curvature? If the reply to these questions is positive, if some virtual particles, vacuum fluctuations – which like *everything* are sources of gravitation and retroactively feel its effect – could provoke a curvature such that the corresponding gravitational energy be sufficient to realize them, we should have, thereby, the origin of a history in which gravitation, through its self-amplifying properties, constitutes a *spring*. A *chain process* would, in fact, be set up: the realization of virtual particles would accentuate the curvature of space-time, which, in turn, would create new particles, and so on. The reply to the question is positive: the empty quantum universe is unstable with respect to *the occurrence of particles of mass above a definite threshold*, corresponding to about fifty 'Planck masses' (the mass built out of the only three universal constants, Planck's constant, the velocity of light, and the gravitational constant, and with a value of some 10^{-5} g). It turns out consequently, that the primordial cosmological actors, in virtue of the quasi-macroscopic mass which they must have, probably belong to that most fascinating class of entities ever construed by physicists: the *black holes*.

Black holes conjure up in the popular imagination of today the end of all history, the collapse of matter, without recovery, into the gravitational trap which such collapse generates. However, black holes, like all objects in contemporary physics, are hybrid beings. Gravitation defines them as trap and singularity, but quantum mechanics obliges them to *evaporate*, attributes to them a lifetime, *a temperature* (that of the particles and radiation which the black hole releases), and hence *an entropy*. It is in this sense that black holes can feature not at the end but at the beginning of cosmological history, and that the products of their evaporation become the constituents, light, and particles of our universe.

A black hole of fifty times the Planck mass will live for about 10^{-37} sec. This would, therefore, be the duration of the 'birth' of the universe, of the self-catalytic transformation of gravitational energy into matter. The entropy of the black holes, deemed to be created during the 'birth' of the universe, is precisely what characterizes the universe we observe.

There are two types of situations given by the same Einstein equations: the empty universe with zero space-time curvature, the flat universe; and our universe, curved and populated. How does one differentiate between empty universe and material universe? The central quantity of Einstein's equations, *energy*, is of no use here. In fact, the two cases are both characterized by total zero energy. In the first, the zero result is the sum of two zero terms: that which characterizes the (zero) curvature of space-time, and that which characterizes the (absent) matter. In the second, it results from the sum of two terms of equal absolute value; one, negative, corresponds to the curvature of space-time, the other, positive, to its matter content. From the energetic point of view, therefore, the transition to existence of the material universe is a gratuitous event. This, in itself, is hardly surprising: energy in physics does not provide the means to tell histories apart; as far as energy is concerned, all possible

histories are the same. Energy defines the invariant to which all evolutions must submit, but sheds no light on their temporal aspect, the difference they create between 'before' and 'after'.

'Before' the transition to existence of its matter content, the entropy of the universe was zero. 'After' this transition, it acquired a value which is the combined value of the entropy of the black holes created. The cost of the transition to existence of the universe is not energetic, therefore, but entropic. The narrative web, which applies to the first instances of the universe, is not, in the manner of the Einstein equations, determined by energy conservation, but by the irreversible growth in entropy defined by the second law of thermodynamics.

The main point is that the transformation of space-time into matter occurs irreversibly, the inverse transformation being impossible.

Indeed a recent reinterpretation of Einstein's equations, characterized by a negative pressure term associated to particle production, has drastically altered the (ir)reversible character of these equations – even though the modification has consequences for only 10^{-37} sec. In spite of this, however, it enables us to express the evolution of space-time, in which particles are created, together with the growth of entropy, proportional to the number of these particles.

In the beginning, therefore, there was a gigantic entropic explosion, of such enormous size that the 'thermal death' to which our universe was doomed, according to 19th-century physicists, can, in comparison, be no more than a residual process. If the total matter of our present universe 'disintegrated' into photons, the entropy of the universe would increase by only a few hundredths of a per cent. Entropic irreversibility, which had always been associated with the end of all history, thus rids itself, here, of the negative sense bestowed on it in the 19th century, haunted, as it was, by the ideal of conservation. It translates into physical terms the realization of the arrow of time, which directs cosmological history, as it directs all physical processes. From this point of view, it can be said that 'Time precedes existence.'

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ILYA PRIGOGINE AND EDGARD GUNZIG

Counterfactuals

Grammar. Among the most obvious examples of counterfactual conditionals are sentences of the type 'If the state of affairs φ had obtained, then χ would have been the case'; that is, combinations of a past perfect if clause with a conditional perfect main clause. They are counterfactual in the sense of being adequately assertible only in circumstances which render false the past tense variants of their antecedent and consequent clauses. In the case of past tense-antecedent plus conditional-consequent conditionals, the antecedent seems sometimes to be meant as still open for realization, so that there is a certain interference with 'open conditionals' of the form 'If φ should obtain, then χ would be the case'. That is why 'counterfactuals' with past tense-antecedent are not counterfactual in the strictest sense. There is no doubt that to differentiate these and other kinds of conditionals syntactically and semantically presents problems for the linguist. But why do they raise a task for the philosopher, too? In what follows I shall use a by now customary piece of notation and render sentences of the type 'If φ were (or: had been) the case, then χ would be (or: have been) the case' by: $\varphi \,\Box\!\!\rightarrow \chi$ (cf. Lewis 1986, Jackson 1987). There are conditionals which at first sight might cast some doubt on the adequacy of such formulae as depicting their logical form. One such case will be considered below.

Truth Conditions and Logical Form. The question of what the truth conditions of counterfactuals look like is related to numer-

ous problems of genuinely philosophical provenience. As was indicated above, we may assume as a rule that the falsity of φ and χ is a necessary condition for $\varphi \,\Box\!\!\rightarrow \chi$ being true. Were $\Box\!\!\rightarrow$ a truth functional operator, then the falsity of φ and χ would also suffice for the truth of the counterfactual. Evidently, this is not the case. It is certain also that we accept as true many counterfactuals which are not such that the antecedent *logically* entails the consequent. This suggests that we interpret many counterfactuals as expressing a kind of dependence stricter than truth functional and less strict than logical dependence. How can one state of affairs bear such a relation of non-truth-functional and logically contingent dependence to another? And when it does, does this constitute a purely objective fact or are epistemic factors, introduced by individuals arguing by means of counterfactuals, irreducibly involved? In other words, is there 'objective modality in nature' (B. van Fraassen, *The Scientific Image*, 1980), that is, modality of the non-logical sort? Assuming that 'causation' is the appropriate label for the kind of dependence in question, then David Hume may be interpreted as affirming that there *is* an essential involvement of subjects, and more precisely of their habits or dispositions to expect certain events given certain others. Nicholas Rescher (1964) is an example of a more recent analysis of counterfactuals that takes into account such epistemic dispositions. Present epistemic analyses of counterfactuals and of strict conditionals in general proceed by combining theories of belief revision with the so-called Ramsey test for conditionals (as it is described in Gärdenfors 1988).

To the extent that the counterfactual seems to refer to non-logical modality, it is *sententia non grata* for strict empiricists. In common discourse, counterfactuals serve among other purposes as the natural means of explaining the meaning of disposition terms. To Rudolf Carnap, faced with the task of describing the construction of an empiricist language ("Testability and meaning", *Philosophy of Science*, 1936–7), this path was not open. Carnap preferred to confine himself rather to non-modal constructions even at the cost of only partially defining the meaning of disposition expressions. Nelson Goodman in his *Fact, Fiction, and Forecast* (1954) shows in detail how the problem of counterfactuals is entangled with this problem of the introduction of dispositions and with other topics of the philosophy of science such as the characterization of lawlike propositions. First of all, Goodman seeks to formulate an acceptable criterion of truth for counterfactuals. Grossly simplifying, we may say that, according to Goodman, $\varphi \,\Box\!\!\rightarrow \chi$ is true in a situation i if there are sets M_1 of propositions true in i and M_2 of acceptable laws of nature which are such that $M_1 \cup M_2 \cup \{\varphi\}$ logically entails χ. It is then easily seen that a minimum requirement for the criterion not to have undesirable consequences is the employment of a notion of acceptable law which excludes non-lawlike ('accidental') generalizations. As an instance of a general proposition which is not to count as lawlike, Goodman mentions a statement saying that every coin in his pocket on a certain day was silver; in case this proposition were not excluded from the admissible sets M_2, one could sustain the truth of a conditional to the effect that a given copper coin would have been silver if it had been in Goodman's pocket that day. As regards Goodman's M_1, one has to think of sentences expressing conditions which are fulfilled in i and which are relevant for χ being connected with φ, but which are such that they can be expected to be fulfilled in normal circumstances (this is why they are not mentioned in the counterfactual). In one of Goodman's examples ("had the match been scratched, it would have lighted"), one such 'relevant condition' is that sufficient oxygen be present.

Goodman spends much effort in looking for suitable restrictions on M_1. He finally reaches the conclusion that in order to characterize the admissible sets M_1 one has already to employ counterfactuals. For according to Goodman each proposition ψ in M_1 must be *cotenable* with φ (if the truth of $\varphi \,\Box\!\!\rightarrow \chi$ is to rest on M_1), and the cotenability of φ and ψ is explained by the condition: it is not the case that ψ would be false if φ were true. In this way Goodman's considerations provide an argument against reductionist analyses of counterfactuals undertaken, e.g.,

with the intention of rendering counterfactuals palatable even to the empiricist. The reductionist position is illustrated by Roderick M. Chisholm's "The contrary-to-fact conditional" (in Feigl and Sellars, eds., *Readings in Philosophical Analysis*, 1949).

Some evidence against interpreting counterfactuals as being of the logical form $\varphi \Box\!\!\rightarrow \chi$ (with φ and χ representing propositions) is provided by the case of propositions like:

(1) if the winner had not bribed the judge, then the winner would not have won (cf. D. Lewis 1973).

Here, one of the arguments of $\Box\!\!\rightarrow$ seems to be the proposition 'the winner did not win'. It is implausible, however, that an inconsistent-looking proposition like that should be part of a perfectly reasonable proposition like (1). Lewis's suggestion is not to abandon $\Box\!\!\rightarrow$, but to symbolize (1) by means of:

(2) $\exists x(x$ = the winner & (x did not bribe the judge $\Box\!\!\rightarrow x$ did not win)).

This is plausible, and it throws light upon a further philosophically important aspect of counterfactuals. Assume that $\Box\!\!\rightarrow$-formulae are interpreted as a kind of strict conditional in the sense of C. I. Lewis, that is (in terms of possible-worlds semantics), as a kind of conditional for which truth means truth of the corresponding material conditional in all elements of a full class of possible worlds. Then (2) comprises a modal *de-re*-predication of the form $\exists x \Box F(x)$ (where $\Box$ is the necessity operator of alethic modal logic). Such predications are characteristic of the metaphysical position of *essentialism*.

Logic and Formal Semantics. A promising way to learn about the semantics of counterfactuals and of non-material conditionals in general is to try to get information about their logical properties by an examination of common discourse. It was quickly noted that there are several peculiarities of the logic of counterfactuals. Hypothetical syllogism, for example, seems to be invalid. In dealing primarily with indicative conditionals, Ernest Adams gives the following example (in "The logic of conditionals", *Inquiry*, 1965):

(1) if Brown wins the election, Smith will retire to private life;
(2) if Smith dies before the election, Brown will win it;
(3) if Smith dies before the election, then he will retire to private life.

Circumstances rendering (1) and (2) acceptable are easily imagined; (3) will in no circumstances be acceptable. The same holds for counterfactual variants of (1), (2), (3). The explanation in terms of a Goodman-type analysis of conditionals is obvious: the negation of the antecedent of (2) is one of the relevant conditions associated with (1); therefore, hypothetically taking this antecedent to be true amounts to being no longer entitled to make use of the connection *normally* holding between the antecedent and consequent of (1) (in case (1) is true).

Attempts have been made to reproduce formally the intuitive logic of counterfactuals with such peculiarities included. Several versions of formal semantics of counterfactuals have been developed for this end (cf. Stalnaker 1984). As yet, the most influential version is that proposed by David Lewis (1973). Lewis's basic idea is: take $\varphi \Box\!\!\rightarrow \chi$ to be true in a situation i if χ holds in every situation in which φ holds and which is *sufficiently similar* to i; here, the degree of similarity counting as sufficient may be different for different counterfactuals. From a Goodmanian point of view, admitting such variation is justified for the following reason: in evaluating a counterfactual relative to i, only those situations are taken into account which are similar to i at least in that the relevant conditions continue to be fulfilled, and these conditions can be completely different for different counterfactuals. Accordingly, Lewis speaks of interpreting counterfactuals as *variably strict* conditionals (in contrast to constantly strict conditionals *à la* C. I. Lewis).

The formal implementation looks like this: a structure is a triple $<W,\$,V>$ with the properties: V is an assignment of truth values to formulae relative to elements of W; $\$$ is a set $\{\$_i | i \in W\}$, and for every $i \in W$, $\$_i$ is a set of subsets of W. $\$_i$ is to have the properties: (1) $\{i\} \in \$_i$; (2) set inclusion is a connex

relation on $\$_i$ ('nestedness-condition'); (3) if $S \subseteq \$_i$, then $\cup S \in \$_i$ and, unless S is empty, $\cap S \in \$_i$. $\varphi \mathbin{\Box\!\!\rightarrow} \chi$ is true in i given $<W,\$,V>$ if and only if one of the following holds: for all $S \in \$_i$ and for all $j \in S$, $V(\varphi,j)$ is f; or: there is an $S \in \$_i$ such that there is a $j \in S$ with $V(\varphi,j) = w$, and $V(\varphi \supset \chi, j) = w$ for all $j \in S$.

Intuitively, W is a set of possible worlds, and for all $i \in W$, $\$_i$ is a set of spheres of similarity around i (where the truth in i of different counterfactuals may rest on different spheres). In demanding nestedness of spheres, Lewis means to take into account the following consideration. If S and T are sets in $\$_i$, then there are corresponding degrees of similarity s and t such that S contains precisely those possible worlds which resemble i to at least the degree s, and analogically for T and t. Now suppose that j is in S but not in T and that k is in T but not in S. Then we have with $d(j,i)$ the degree of similarity of j to i and with $d(k,i)$ the degree of similarity of k to i: $d(j,i) \geqslant s$, $d(j,i) < t$, $d(k,i) \geqslant t$, $d(k,i) < s$, and this entails $t > s$ and $s > t$. This argument in favour of nestedness presupposes, of course, that for any two worlds there exists a unique degree of overall resemblance which does not depend on peculiarities of the counterfactuals which are to be evaluated.

If we imposed the restriction that sets of spheres of similarity include only one element, the Lewis semantics would turn into a semantics for constantly strict conditionals. This is precisely the restriction which would render hypothetical syllogism a valid scheme of inference for counterfactuals.

As was to be expected, Lewis's and Goodman's accounts are closely connected. For assume $\varphi \mathbin{\Box\!\!\rightarrow} \chi$ to be true in i in Goodman's sense. Take j to be sufficiently similar to i if the elements of M_1 and M_2 – which are supposed to be true in i – are also true in j. Let S be the corresponding similarity sphere. Then truth of $\varphi \supset \chi$ in all elements of S means: each world which is a model of $M_1 \cup M_2 \cup \{\varphi\}$ is a model of χ, that is, $M_1 \cup M_2 \cup \{\varphi\}$ entails χ.

Lewis's account still has shortcomings. $(\varphi \,\&\, \chi) \supset (\varphi \mathbin{\Box\!\!\rightarrow} \chi)$, for example, is a formula which is not acceptable as valid, which is, however, validated in Lewis's semantics as a consequence of condition (1). Lewis himself therefore considers weakening (1). Another problem is with nestedness. We may expect that for any true counterfactual the verifying sphere should be conceived of as being as wide as possible; in particular it should contain – against Lewis's idea of overall resemblance – all worlds which behave as we like in respects irrelevant to the counterfactual in question. (In other words: it seems reasonable not only to allow variation of what is to count as a sufficient degree of similarity, but to allow variation of the similarity measure itself.) This, however, blocks nesting of the associated spheres of two counterfactuals whenever there is an aspect of situations which is relevant as regards the first but irrelevant as regards the second, and vice versa. Nestedness seems in any case to be hardly acceptable; for example it has the consequence that

$$((\varphi \mathbin{\Box\!\!\rightarrow} \chi) \,\&\, ((\varphi \,\&\, \neg\psi) \mathbin{\Box\!\!\rightarrow} \neg\chi)) \supset (\varphi \mathbin{\Box\!\!\rightarrow} \psi)$$

is valid.

We may hope that by further refinement of formal semantics, presumably along Lewis's line, these and other deficiencies will be removed. But even if at any time we should possess semantical tools adequate to reproduce precisely the logic of counterfactuals as it shows up in our linguistic behaviour, one thing will not be accomplished: we will not thereby have a recipe for settling controversies about the truth value of particular counterfactuals. For as D. Lewis points out, we are actually able to get a fairly clear picture of the dependence of the truth of a counterfactual on factors such as a similarity relation between possible worlds (and this picture is what matters for logic); but the truth conditions of counterfactuals will remain blurred to the extent that these relations (which rest, e.g., on shaky estimations of relevance) are themselves blurred.

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ULRICH NORTMANN

Cramer, Wolfgang

Wolfgang Cramer, born in 1901 in Hamburg, is one of the most individual and independent German thinkers of this century. A pupil of Richard Hönigswald (1875–1947) and Moritz Löwi (1891–1942), he began his university career in 1935 in Breslau; in 1951 he went to Frankfurt/Main where he died in 1974.

The starting-point of Cramer's thinking is the monad, understood by him as a developing psychophysical unit. Consciousness and self-consciousness he sees not as a 'direction towards' but rather in terms of a 'generating from' (*Grundlegung einer Theorie des Geistes*, Frankfurt/Main, 1957). Cramer's theory of consciousness is, then, a theory of production. The products of perception and experience (*Erleben*) have, he claims, the same monadic origin as those of thinking. Transcendental philosophy, the theory of 'the constitution of the matter of consciousness', is preceded by a transcendental ontology that deals 'with the ontological constitution of subjectivity'. Since one must "establish the monad as origin in another origin" (*Die Monade*, Stuttgart, 1954), the question concerning ultimate foundations or causes leads to the idea of determination-itself (*Bestimmtheit-selbst*). This, Cramer argues, cannot be imagined as non-existent and is an absolutely necessary being, which he calls 'God'. The themes of Cramer's philosophy (self, God, world) are those of the older metaphysics; his philosophy is a post-Kantian 'metaphysics of the transcendent'.

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REINHARD FINSTER

Crescas, Hasdai

Hasdai Crescas (*c.* 1340 – *c.* 1410) was a Spanish rabbi, philosopher, and author of the anti-Aristotelian Hebrew classic *The Light of the Lord* (or *Adonai*).

The *Light* is a response to Jewish philosophers like Moses Maimonides and John Gerson, who had interpreted Judaism in Aristotelian terms. Seeking to free Judaism from Aristotle, Crescas subjected Aristotelian physics to a radical logical and conceptual critique. He rejects Aristotelian theories of space, time, and motion. He defines space as dimensionality, i.e., "the interval between the limits of that which surrounds". He argues for the existence of a vacuum and of an actual infinity of both number and extension. He portrays the universe as an infinitely extended vacuum containing many (perhaps infinitely many) worlds. He defines time as "the measure of the continuum of motion or rest between two instants", and conceives it as eternal *a parte ante* and *a parte post*. Time, he holds, is 'in the soul', and not dependent on the existence of physical objects. Space and time are thus analogous: both are infinite continua and independent of the existence of physical objects. There are points of contact between Crescas's criticisms of Aristotelian science and those of philosophers at the University of Paris, especially Nicole Oresme. Parts of Crescas's critique were translated into Latin in Giovanni Pico della Mirandola's *Examen doctrinae vanitatis gentium* (1520).

Crescas rejected Maimonides's proofs of God. He himself offers one metaphysical proof: whether causes and effects are finite or infinite, there must be some cause of the whole of them; for if all were effects, they would all be of possible (or contingent) existence, and would require something to give preponderance to their existence over their non-existence. The proof makes use of a Kalamic notion of preponderance (cf.

Maimonides, *Guide of the Perplexed*, I, 74, 6th Method) and Avicenna's concept of possible vs. necessary existence (cf. *Guide*, II, 1, 3rd Philosophic Speculation), but significantly allows for an infinite chain of causality. Spinoza quotes Crescas's proof in his Letter on Infinity (*Epistle* 12, to Meyer). Crescas, however, holds that true knowledge of God is based on prophecy, and philosophic proofs can only incline one toward that knowledge.

Crescas argues for strict physical determinism. Voluntary acts, like all things, are necessitated by causes; but they are distinguished from non-voluntary acts in that they are in accord with imagination and appetite (the two faculties which constitute the will), and thus are not accompanied by a feeling of compulsion. Crescas's physical determinism coheres with a theological determinism: God is the ultimate cause of all.

In his doctrine of God, Crescas holds a theory of essential attributes and amphibolous (or analogical) predication. The attributes are infinite in number, but all are mental modifications of the attribute of goodness. The relation of the attributes to God is like that of light to a luminous object, or, in a metaphor borrowed from the mystical *Book of Creation* (Sefer Yesirah), "like a flame joined to the coal". God infinitely creates the universe in joy and love, and love is the *telos* of man and of all creation.

Crescas studied under Nissim ben Reuben of Gerona, a renowned Talmudist and author of philosophical homilies. Among Crescas's students was Joseph Albo (*c.* 1380–*c.*1444), author of the popular philosophic *Book of Roots*. Crescas's philosophy had a marked impact on Leone Ebreo and Spinoza.

Other writings of Crescas include *Refutation of the Dogmas of the Christians*, a philosophic critique of Christianity written in Catalan but surviving only in a 15th-century Hebrew translation; and *Sermon on the Passover*, a philosophic homily written in Hebrew.

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WARREN ZEV HARVEY

Crusius, Christian August

Christian August Crusius (1715–75), whose interests in theology and philosophy were equally pronounced, represents both the peak and the conclusion of the philosophy of the German Enlightenment directed against Christian Wolff. The intellectual roots of this philosophy are to be found in the Pietistic tradition founded by Christian Thomasius (1655–1728). Adolf Friedrich Hoffmann (1703–41) was, more than any other, the teacher of Crusius, but the influence of Andreas Rüdiger (1673–1731), John Locke (1632–1704), Nicolas Malebranche (1638–1715), Joachim Georg Darjes (1714–91), Samuel Christian Hollmann (1696–1787) and even of Leibniz is recognizable. In the era of the 'Leibnizian–Wolffian School Philosophy' Crusius distinguished with often remarkable clarity between the thought of Leibniz and Wolff – a rarity at the time. Crusius was born in Leuna near Merseburg and remained throughout his life in Leipzig, turning down all offers of appointments elsewhere. He taught philosophy for some ten years at the University of Leipzig, and occupied the chair of theology from 1750.

Two fundamental axioms dominate Crusius's philosophy, both leading back to Thomasius, and both diametrically opposed to Wolffian philosophy:

1. Philosophy is the science not of the possible but of the real.
2. The capacity of human knowledge is fundamentally limited, so that a consistent and all-pervasive rationality or intelligibility of the world may not be assumed.

Because philosophy does not deal, as mathematics does, with merely possible relations, Crusius rejects the mathematical

method in philosophy. Real things and not the *ens qua ens* are the subject matter of ontology, the first part of metaphysics (cf. *Entwurf der nothwendigen Vernunftwahrheiten*, Leipzig, 1745).

Ontology is concerned also with the 'principle of sufficient reason'. Crusius's reformulation of this principle – anything that happens requires a determining reason why it is the way it is, except for free acting which only requires sufficient reasons (cf. *De usu et limitibus*, Leipzig, 1743) – and his clear conceptual differentiation of *causa cognoscendi* (reason of knowledge) and *causa essendi* (reason of being) as well as of sufficient and determining reason, have had the strongest and most lasting impact of the entire Crusian philosophy.

The high priority of theological thought in the philosophy of Crusius is seen in the fact that revealed understanding is at times regarded as having equal status with natural understanding. It is seen also in the fact that the second part of metaphysics is for Crusius natural theology. The third part consists of cosmology, the *a priori* science of the necessary being of any world whatsoever. Crusius supported in regard to the mind–body problem the interactionistic theory of the *influxus physicus*, and according to him spirited substances belong of necessity to any and every world.

The final part of Crusius's metaphysics (of which empirical psychology does not form a part) is pneumatology. Here understanding, reason, and will in spirits are differentiated, the will being distinguished as the dominating force.

Crusius defines – in close relationship to his reformulation of the principle of sufficient reason – the essence of freedom as a force to determine oneself to an action without being determinated by anything else, be it inherent or external to the acting subject. His theory of *libertas indifferentiae seu aequilibrii*, according to which freedom consists in the indifference of equilibrium, is expressively a critique of the Leibnizian theory, according to which a free act always requires a (determining) reason why it is done the way it is. Leibniz refuses the theory of indifference, represented for example by Luis de Molina (1535–1600), as a theory of arbitrary but not free acting. The ass of Buridan is in such a situation of indifference, standing between two trusses of hay and having no reason to decide for one of them – and consequently it dies of hunger. Crusius's theory of freedom finds echoes in Kant's idea of transcendental freedom in the *Critique of Pure Reason*. Crusius also exerted a strong influence on philosophers such as Christian Friedrich Krause (1721–48) and Franz Volkmar Reinhard (1753–1812). Also Gottlob Ernst Schulze (1761–1833), later the teacher of Arthur Schopenhauer (1788–1860), was a follower of the philosophy of Crusius. A thorough history of the reception of Crusius is still missing.

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REINHARD FINSTER

Cusa. See: Nicholas of Cusa

D

Daubert, Johannes

Johannes Daubert was born in Braunschweig in 1877 and from 1898 he studied in Munich under Theodor Lipps. Daubert is noteworthy above all for having been the first to recognize the importance of Edmund Husserl's *Logical Investigations*. In early 1902 he contacted Husserl who, from that time on, con-

sidered him to be his most gifted and influential follower and indeed his only congenial contemporary. Between 1902 and 1905 Daubert implanted Husserl's new ideas in Munich by way of lectures to, and discussions with, his fellow-students. From these activities there sprang both the Munich and – via Daubert's disciple Adolf Reinach – Göttingen Schools of phenomenology. These earliest branches of the 'phenomenological movement' subscribed to an ontological realism of the Daubertian sort. They accordingly rejected Husserl's later transcendentalism, though they were strongly influenced by Husserl's interests in logic and language. Daubert was an independent and highly critical thinker (even with regard to Husserl). In fact he was so self-critical that he never published a line. After World War I he became a farmer, yet resumed his philosophical activities around 1930 (defending, for example, an interpretation of Husserl's concept of the noema along the lines of Aron Gurwitsch). Daubert died in 1947. His ideas have survived in shorthand manuscripts dating from the period between 1902 and 1914 and again from 1930 and 1931.

Daubert's realism comes to the fore in his theory of judgement, where he opposes the *Sachverhalt* or real state of affairs – the ontological correlate of a veridical judgement – to the act of judging and to the judgement's meaning. Judgements can be true or false, where states of affairs simply exist. Judgements, but not states of affairs, are repeatable.

States of affairs as Daubert conceives them are neither the inarticulate things given in perception, nor are they complexes which would contain such things (or properties thereof) as parts. States of affairs have no parts, but rather 'members', since they are not wholes, but unities of a special sort. A state of affairs comes to the fore when our attention brings into relief given aspects or elements of a thing and thereby directs a judgemental intention to it. Hence, while states of affairs are real existent entities, their existence depends both on things and on associated intentions.

Similar distinctions are applied in an analysis of speech acts, more precisely in the phenomenology of questioning, which Daubert developed in 1911. Daubert distinguishes the empirical act of questioning from the question itself. The latter is an ideal thought-formation (comparable to a proposition). It is expressed in a question-sentence which is normally directed to another person and refers to a special entity called *Frageverhalt* or *state of affairs as questioned*. The latter, in contrast to the state of affairs as judged, does not depend completely upon things given, for the relevant matter of fact is precisely not present as a whole to the person who raises a question about it.

In his late manuscripts Daubert develops the consequences of his realism with regard to consciousness. Consciousness, he states, has no reality of its own, but is an intentional function of psychic processes occurring in (human) organisms. It exists only in so far as it is in touch with reality and picks out what is present in the world.

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KARL SCHUHMANN

Davidson, Donald

Donald Davidson (b. 1917), a philosopher influenced especially by W. V. O. Quine and Alfred Tarski, teaches philosophy at the University of California, Berkeley. His philosophical views concerning the relationship between our conceptions of ourselves as persons and as complex physical objects have had significant impact on the contemporary philosophical scene.

Events. Davidson regards the mind–body problem as the problem of the relation between mental and physical events. Causation he treats as a relation between events, and

action he takes to be a species of event, so that events make up the very subject matter of action theory. His central claim concerning events is that they are concrete particulars – that is, unrepeatable entities with location in space and time. He does not take for granted that there are events, but argues for their existence and for specific claims as to their nature.

In "Causal relations" (reprinted in 1980), Davidson argues that the most plausible interpretation of singular causal statements like "The short circuit caused the fire" treats them as having the form of two-place predicate statements, with their singular terms – in this case, 'the short circuit' and 'the fire' – functioning to designate events. In "The individuation of events", Davidson argues that a satisfactory theory of action must recognize that we talk of the same action under different descriptions. We must therefore assume the existence of actions, for otherwise we could not make sense of talk like "Jones managed to apologize by saying 'I apologize'". He also argues that we cannot make sense of explanation and description and redescription without positing events (1980, pp. 164–5).

The Method of Truth in Metaphysics. The strongest sort of argument Davidson has for the existence of events derives from his most original contribution to metaphysics, the semantic method of truth, originating in papers reprinted in his 1980 and 1984. Any semantic theory for a language must embody a view of the relationship between language and reality. Davidson's conviction is that a semantic theory, by providing a view about this relationship, will provide substantive answers to the various metaphysical questions about reality. In particular, it will require events in order to make possible an explanation of the semantic (logical) form of action, event, and causal statements.

An adequate semantic theory for a language *L* will issue in Tarski-like theorems for every sentence *S* of *L* of the form '*S* is true if *p*', where *p* can be replaced by a sentence which states the conditions under which *S* is true. Consider the English sentence (1). One obvious candidate for its truth condition is (2):

(1) John hit Bill.
(2) "John hit Bill" is true if John hit Bill.

In (2), language is both mentioned and used and in this sense (2) 'hooks up' language to reality. This hook-up remains silent on the nature of reality. It simply tells us that the English sentence (2) requires for its truth that John hit Bill. To see why Davidson finds so much metaphysical bite in his semantics, we need to say more about his approach to a theory of meaning.

An adequate semantic theory must be finite (1984, pp. 4–15). If we try to construct a semantic theory for, say, English, then we are forced to read recursive structure into the sentences of English, since this seems the only way to generate infinitely many sentences from a finite vocabulary. Consider, now, sentences like:

(3) John hit Bill at six.
(4) John hit Bill at six in the bedroom.
(5) John hit Bill at six in the bedroom with the stick.

There are no specifiable limits upon the number of kinds of adverbial modifiers which can sensibly attach to sentences of this sort. Therefore, treatment of each distinctively modified sentence as involving a distinct primitive relation threatens to offend against the condition that a semantic theory be finite. On the basis of considerations of this sort, Davidson proffers a proposal which reveals the common elements in these sentences, issues in the correct semantic truth conditions, and validates the requisite implications, e.g., that (4) implies (3), and so forth. His idea, roughly, is to assign semantic structure to sentences like (1) and (3)–(5) in such a way that they are 'revealed' as harbouring existential quantifiers with these quantifiers ranging over events. The thesis that there are events is true, because the semantics requires quantification over these entities. This technique for discerning ontological commitments extends to all those cases where quantification and predication are required in order to construct a satisfactory semantics for natural language. The method is a general method for doing ontology.

Anomalous Monism. Consider the following claims:

(i) The mental and the physical are distinct.
(ii) The mental and the physical causally interact.
(iii) The physical is causally closed.

Much has been said in favour of each of these claims. The trouble, though, is that (i)–(iii) seem inconsistent. Consider their application to events. (i) says that no mental event is a physical event; (ii), that some mental events cause physical events and vice versa; and (iii), that all the causes of physical events are physical events. The dilemma posed by the plausibility of each of these claims and by their apparent incompatibility is the traditional mind–body problem. Davidson's resolution of the dilemma consists of the three theses:

(iv) There are no strict psychological or psychophysical laws, and in fact all strict laws can be expressed in a purely physical vocabulary.
(v) Mental events causally interact with physical events.
(vi) Event *c* causes event *e* only if there is a strict causal law which subsumes *c* and *e*.

(iv) is a version of (i). It is commonly held that a property expressed by *M* is reducible to a property expressed by *P* (where *M* and *P* are not logically connected) only if there is an exceptionless law that links them. So, it follows from (iv) that mental and physical properties are distinct. (vi) says that *c* causes *e* only if there are singular descriptions *D* of *c* and *D'* of *e* and a 'strict' causal law *L* such that *L* and '*D* occurred' entail '*D* caused *D*'' (1980, p. 158). (vi) and the second part of (iv) entail that physical events have only physical causes and that all event causation is physically grounded.

Given the parallel between (i)–(iii) and (iv)–(vi), it may seem that the latter, too, are incompatible. But they are not. Davidson shows that they can all be true if (and only if) mental events are identical to physical events (1980, p. 215). Let us say that an event *e* is a physical event just in case *e* satisfies a predicate of our basic physical sciences. These are the predicates appearing in 'strict' laws. Since only physical predicates (or predicates expressing properties reducible to basic physical properties) appear in 'strict' laws, it follows that every event that enters into causal relations satisfies a basic physical predicate. So, those mental events which enter into causal relations are also physical events. Notice though that the anomalous monist is committed only to a partial endorsement of (i). The mental and physical are distinct in so far as mental and physical events are not linked by strict law – but they are not distinct in so far as mental events are physical events.

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ERNEST LEPORE

De Dicto/De Re

Quite often there arises an ambiguity in the scope of certain expressions. When we consider for instance

(1) if a proposition *p* is true, then necessarily the fact expressed by *p* obtains,

then it is obvious that this has two meanings according to whether 'necessarily' is applied to the conditional as a whole (*sensus compositus*) or only to its consequence (*sensus divisus*). This medieval distinction between *sensus compositus* and *sensus divisus* was often formulated also as the distinction between modalities *de dicto* and *de re*. Nowadays the distinction is applied not merely to modal expressions but also to expressions which qualify intentional acts.

Intentional Acts. Consider the sentence:

(2) John believes that a Republican will win.

Here there is an ambiguity. John's belief may refer to a determinate person, to which the term 'a Republican' refers and of whom John believes that he will win. In this case one says that the term 'believe' is applied *de re* (or also: that the term 'a Republican' has a *de re* reference). But one may interpret (2) also as: John believes that the proposition 'a Republican will win' is true even though he is not thinking of any determinate person. In this case the term 'believe' occurs *de dicto*. It is not easy to analyse the difference between these two intentional acts. One widespread account affirms: first, the distinction between *de dicto* and *de re* readings must be reflected in the analysis by a difference of scope; second, the relation of believing must be interpreted as a relation between a subject and an abstract entity called 'intension' (intuitively: meaning).

If α is an expression, let $\ulcorner \uparrow \alpha \urcorner$ be the name of the intension of α and 'Bel' an abbreviation of 'believe'. For the *de re* interpretation the analysis of (2) will be:

(2a) $\exists x\,[R(x)\ \&\ \mathrm{Bel}\ (j,\ \uparrow(W(x)))]$

and for the interpretation *de dicto*:

(2b) $\mathrm{Bel}\ (j,\ \uparrow(\exists x[R(x)\ \&\ W(x)]))$.

It is worth noting that (2) admits also the interpretation:

(2c) $\exists x\,[\mathrm{Bel}\ (j,\ \uparrow(R(x)\ \&\ W(x)))]$,

as also the conjunctions of (2a) and (2c). It has been suggested that it would perhaps be more appropriate to distinguish between the act of reference of the subject who thinks proposition (2) (linguistically: the speaker's description) and the referring act of the person who is believing (John's own description).

The need for this distinction is more obvious in:

(3) Columbus believed that Castro's island was China,

and it may be applied also against the Twin-Earth argument of Hilary Putnam (1975), in view of the fact that the pair of statements:

(4) Oscar_1 believes that H_2O is water
(5) Oscar_2 does not believe that H_2O is water

implies a contradiction in the assumptions of Oscar_1 and Oscar_2 about the extension and meaning of 'water' only if 'H_2O' is the identical description of both Oscars, i.e. only if 'believes' occurs *de dicto* in (4) and (5).

This shows the fertility of making a *de re*/*de dicto* distinction in the analysis of intentional acts. Yet it seems difficult to specify the ontological status of the *intensions* which allow quantifications like (2a)–(2c). The semantics of Richard Montague (1930–71) seems in this respect to clarify Gottlob Frege's concept of meaning (*Sinn*). This identifies an *intension* with a function from the Cartesian product of the set W of possible worlds w with the set T of times t into the set of extensions (sets, individuals, or truth-values). The problem of this set-theoretical explanation of intension, however, is that the intension of a necessary proposition would be the function which for every pair $<w, t>$ computes the value truth. But this would imply that if John knew one necessary truth, then he would know all necessary truths, which is counterintuitive. One of the aims of H.-N. Castañeda's Guise Theory is to resolve ontologically this and other puzzles of intensions.

Modalities. A modal operator occurs *de dicto* if it is a prefix of a logically compound sentence like:

(6) Necessarily there exists a last card in the pile,

or if it is prefixed to a simple sentence but indicates a property (for example, necessary

truth) of this sentence, as in:

(6′) It is necessary that the number of planets is greater than 7.

The occurrence is *de re* if the modal operator is the prefix of a logically simple sentence and indicates the manner in which the subject of the sentence satisfies a certain property; for example:

(7) There is a card that is necessarily the last one in the pile.

(7′) The number of planets is necessarily greater than 7.

Cases (6′) and (7′) show that it is not a matter simply of the scope of a modal term after translation into standard logical notation. The expression

$$\Box(n > 7)$$

may equally serve as a reading of both (6′) and (7′).

If ϕ expresses a trivial property such as self-identity, possessed by all objects, then the meaning of a sentence with modalities *de re* like

(8) $\forall x \Box \phi(x)$

does not involve major problems. The meaning of sentences like:

(9) $\Box \phi(a)$

(10) $\exists x \Box \phi(x)$,

however, is unclear: W. Kneale (1962) has argued against the use of modalities *de re* because the affirmation of (9) and (10) implicitly alludes to a description or property which we can always eliminate. For Kneale *a* may only then be necessarily ϕ if *a* is comprehended as under a determinate description $(\iota x)\, G(x)$. Thus only an *a qua* G is necessarily a ϕ. The necessity would then belong not to *a* at all, but to the relation between G and ϕ. In this case, (9) would have be to retranslated by means of an expression *de dicto* like:

(11) $\Box \forall x(G(x) \rightarrow \phi(x))$

Worse would be the case (10) because one wants to say that the object has the property ϕ either as a result of satisfying any property at all or only as a result of satisfying some particular property. In the first case the analysis would be

(11a) $\exists x \forall G \Box(G(x) \rightarrow \phi(x))$

and then ϕ would have to be a trivial property, as in (8). In the second case (11) would have to be understood as meaning something like:

(11b) $\exists x \exists G \, \Box \, (G(x) \rightarrow \phi(x))$

which makes (11b) then trivially true because ϕ is just like G. This concludes the argument to the effect that propositions like (9) and (10) lack a (non-trivial) meaning.

Against this, Alvin Plantinga has shown that the argument of Kneale is based only on the belief that it is impossible for an object *a* to possess essentially a property ϕ (or possess the property $\Box\phi$) independently of language. But this would eliminate the modalities *de dicto*, too. A reading *de dicto* of a sentence is then equivalent to a reading *de re* where the subject is a proposition and the property is the property to be true. Hence if one refuses the modalities *de re*, then one must in an analogous way refuse the idea that propositions could be necessarily true independently of the way in which they are expressed.

It is important to observe that this and other debates already involve – whether consciously or not – the distinction *de dicto* and *de re*. Arguments against modal quantification like W. V. O. Quine's planet-puzzles often rest on a confusion similar to that which mixes (6′) and (7′). Thus a great deal speaks in favour of the distinction *de dicto* and *de re*, in so far as this distinction refers to non-epistemic modalities.

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CARLOS A. DUFOUR

Definite Descriptions

Definite descriptions are expressions like 'the inventor of bifocals' that characterize objects as uniquely satisfying a particular set of properties. Indefinite descriptions such as 'an idea whose time has come' by contrast may truly and non-uniquely be predicated of many different objects.

The classical analysis of definite descriptions is given by Bertrand Russell in "On denoting", and later in *Principia Mathematica* and his *Introduction to Mathematical Philosophy*. Russell analyses atomic propositions containing definite descriptions as an existentially quantified conjunction of three components:

1. an existence condition;
2. a uniqueness condition;
3. a predication.

The sentence 'The man who ran away is tall' is analysed on this scheme as: There exists a man who ran away; there exists one and only one man who ran away; that man is or has the property of being tall.

Russell exploits the analysis to resolve a variety of semantic problems about ostensible reference to non-existents. In 'The present King of France is bald', there is an apparent or attempted designation of the present king of France, who, of course, does not exist. The proposition is not meaningless, but to judge it true or false seems equally to posit a present king of France. Russell avoids the dilemma by using the theory of definite descriptions to expose an ambiguity in the scope of negation.

Let 'ι' be a definite descriptor. Where B is the property of being bald, and K the property of being present king of France, Russell's theory states: $B(\iota x(Kx)) \equiv (\exists x)[Kx \,\&\, (\forall y)(Ky \equiv (x = y)) \,\&\, Bx]$. On this analysis, the sentence turns out to be false, since the existence condition is unsatisfied, which renders the entire existentially quantified conjunction false. Russell appeals to an ambiguity of scope in the placement of negation in $\neg B(\iota x(Kx))$ under interpretation as implying either $\neg(\exists x)[Kx \,\&\, (\forall y)(Ky \equiv (x = y)) \,\&\, Bx]$ or $(\exists x)[Kx \,\&\, (\forall y)(Ky \equiv (x = y)) \,\&\, \neg Bx]$. The former yields a true sentence; the latter, a contingent falsehood. The ambiguity in 'It is false that the present King of France is bald', which seems to indicate that the sentence invalidly implies the existence of a non-bald present king of France, is resolved. The theory provides an alternative location for the negation, so that when negation attaches to the sentence as a whole the apparent ontically undesirable consequences of the unanalysed sentence are not entailed.

Russell's theory of descriptions has been influential in the rise of modern analytic philosophy, prompting F. P. Ramsey in his essay "Philosophy" to eulogize it as "that paradigm of philosophy". And so it is, for better or worse, but specifically of *extensionalist analytic* philosophy. It is therefore worthwhile to test the theory against an intensionalist objection. Consider the intuitively true proposition, 'The winged horse is mythological'. Let W represent the property of being a winged horse, and M the property of being mythological. On Russell's three-part analysis the proposition reads:

$$M(\iota x(Wx)) \equiv (\exists x)[Wx \,\&\, (\forall y)(Wy \equiv (x = y)) \,\&\, Mx]$$

The interpretation is unsound, since it converts a true into a false proposition.

Defenders of Russell's theory will quickly point out that the predicate 'mythological' on which the counterexample turns is in a different category from ordinary predicates like 'horse'. If the winged horse is mythological, then it is non-existent (and described in myth with the words 'the winged horse' or their equivalents inscribed in fables). If for convenience we ignore the second component concerning literary context, then to say that

the winged horse is mythological is just to say that the winged horse does not exist.

The first step toward a correct analysis of the proposition might then be: $M(\iota x(Wx)) \equiv \neg(\exists x)(\iota x(Wx))$. The equivalence is true, if both constituent propositions are true (assuming that the winged horse does not exist, and that non-existence exhausts the property of being mythological). But when Russell-style analysis is applied to the definite description in the right half of the biconditional, the equivalence is counterintuitively made false, and with it the orginal proposition that the winged horse is mythological. It follows that:

$$M(\iota x(Wx)) \equiv (\exists x)[Wx \ \& \ (\forall y)(Wy \equiv (x = y)) \ \& \ \neg(\exists x)Wx]$$

Russell's analysis reduces an intuitively true proposition about the mythology of the winged horse to the false proposition that a mythological winged horse exists. It further converts the contingent truth that the winged horse is mythological (an empirical question to be decided by scientists, historians, and literary scholars), to the logical inconsistency or necessary falsehood that a winged horse exists and does not exist. Equipped with Russell's theory of definite descriptions, an investigator need only logically analyse propositions about the non-existent creatures of myth and fiction ostensibly designated by definite descriptions in order to determine *a priori* that all such objects are *logically* impossible.

The problem lies in the extensionalist demand that definite description entails existence, reflected in the first conjunct of Russell's analysis. A related set of criticisms is raised by P. F. Strawson, who distinguishes between propositions and statements made in context by means of sentences. Strawson claims that Russell is wrong to hold that sentences imply, but argues instead that they presuppose, the existence of objects to which properties are attributed. This in part shifts the burden of philosophical analysis from the sentence to the speaker and the presuppositions intended by the speaker in using a particular sentence to make a statement. If Strawson's counteranalysis is correct, Russell's existence thesis for the objects of definite descriptions does not obtain.

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DALE JACQUETTE

Definition I: History

A *definition* (Latin *definitio* – delimitation) is a procedure (or the result of a procedure) by which the meaning of a linguistic expression is determined or explained. Accordingly there are two main kinds of definitions: *synthetic* or *stipulative definitions*, which introduce new expressions into a language via a decision fixing their meanings, and *analytic* or *lexical definitions*, which report on the existing meanings of expressions of a language. Traditionally, one distinguished between nominal and real definitions. A *nominal definition* amounts to an abbreviation of one complex expression by means of another. A *real definition*, in contrast, purports to give the concept (*conceptual definition*) or the essence (*essential definition*) of an object.

According to Plato, the definition of essences or ideas is one of the most important aims of philosophy. In connection with this approach, Aristotle developed the beginnings of a general theory of definitions: the concept of a species is to be defined by giving the next higher genus and the specific differences. Thus, e.g., in the definition of 'man' as 'rational animal', the concept 'animal' is a genus and 'rational' is a specific difference. While for Aristotle definitions express the

essence of things, he speaks also of definitions of the names given to things.

The question whether definitions relate to words or to things was a central problem above all for the Scholastics. Whereas the Nominalists account definitions as purely linguistic constructions, for adherents of Realism only real definitions are of worth. In the post-scholastic era, Thomas Hobbes and John Locke rejected real definitions. According to Leibniz, real definitions differ from simple nominal definitions in that they not only fix or explain the meaning of expressions, but also state the logical or real possibility of corresponding things. In a similar way, John Stuart Mill (1806–73) regarded every so-called real definition as a nominal one bound together with a statement of existence of a corresponding object.

The foundation of the theory of definitions in modern logic stems from Gottlob Frege (*Grundgesetze der Arithmetik*, I, 1903; "Über Logik in der Mathematik", 1914). Definitions, according to Frege, are means for the construction or extension of precise terminologies. To define an expression is to introduce it into an artificial language by stipulating its meaning in terms of the expressions already available in the language. In this sense, definitions are always synthetic. They have no truth value, but are either correct or incorrect depending on the satisfaction of certain logical principles. With regard to any artificial language, Frege argues, one has to distinguish between expressions which are and are not defined in the language. The latter are called the *primitive expressions* of the language.

The main purpose of introducing a definition into a formal theory is to make proofs more convenient. Such an idea is expressed by two criteria originating with B. Pascal (1623–62) and formulated in precise form by Stanisław Leśniewski ("Definitionen in der sogenannten Theorie der Deduktion", 1931). The criterion of *eliminability* states that it should be possible to replace any formula containing a defined expression by an equivalent formula not containing that expression. The criterion of *non-creativity* states that a definition should not function as an axiom, i.e., whatever is provable in a theory on the basis of the axioms with a definition added to them has to be provable also without that definition. Leśniewski himself emphasized that definitions can render valuable support in the building of realistic logical maps of the world. In this sense, they are by no means arbitrary.

Modern logic discriminates between several types of definitions for which it formulates logical formation rules. An *explicit definition* has the form of an equivalence $A \equiv B$ or an identity $A = B$. Frequently, one writes those definitions also in the style: $A =_{\mathrm{Df.}} B$. The expression being defined is called *definiendum*, and the defining expression the *definiens*. The choice of the form of an explicit definition depends on the syntactic category of the expression being defined. Predicates are usually defined by equivalences (e.g. x is an effect of $y \equiv y$ is a cause of x), while definitions of terms and term-forming functors take the form of identities (e.g. the universe $= \iota x \forall y$ (y is a part of x)).

In contrast to an explicit definition in the strict sense, the *definiendum* of a *contextual definition* contains also primitive expressions or expressions being defined in advance (e.g. the cause of $y = x \equiv y$ is a cause of x). In these cases it has additionally to be shown that there is exactly one entity satisfying the conditions of the *definiens*. Frege accepted only explicit definitions in the strict sense as definitions proper.

A *conditional definition* has the form of an implication $C \supset (A \equiv B)$ or $C \supset A = B$ in whose antecedent a certain condition C is formulated (e.g. the definition of division must be preceded by the condition preventing division by zero). Whereas an explicit definition conforms to both the criterion of eliminability and that of non-creativity, a conditional definition does not fully satisfy the former, since it allows the replacement of the *definiendum* by the *definiens* only if the relevant condition is satisfied. Rudolf Carnap's *reduction sentences* introducing so-called disposition predicates are a special case of these definitions ("Testability and meaning", 1938). Because of their creativity such definitions are frequently accounted as statements.

A *recursive* or *inductive definition* consists of two parts having the form of explicit definitions. In the first part the expression is defined with regard to an elementary case, and in the second it is defined for the other cases. Thus, for example, the definition of addition consists of two clauses: (1) $y + 0 = y$, (2) $y +$ the successor of $x =$ the successor of $(y + x)$. Leśniewski demonstrated that some recursive definitions are creative.

There are contrary positions as to whether two further ways of determining a meaning, the so-called 'implicit' and the 'ostensive' definition, deserve the name 'definition'. Both introduce primitive expressions by showing how they are used and do not appeal to expressions given in the language. Thus the requirements of eliminability and of non-creativity remain unsatisfied. According to David Hilbert, every set of axioms of a theory constitutes an *implicit definition* of the primitive expressions involved in that theory. (A classical example is his axiomatization of geometry.) A related notion is that of *meaning postulate* introduced by Carnap in his *Meaning and Necessity* of 1956. A so-called *ostensive* or *deictic definition* (Bertrand Russell) introduces an expression by pointing to corresponding objects.

Statements about meanings of expressions are often called *meaning analyses*. Some authors, however, see lexical explanations formulated in terms of expressions already learnt as examples of analytic definitions. In contrast to synthetic definitions, these are either true or false. We can distinguish in addition what Carnap calls an *explication*, whereby an expression is taken from a natural language and its meaning modified to rule out vagueness or ambiguity. Such an improvement comprises elements pertaining both to analytic and to synthetic definitions. Those procedures which were called real definitions in the past are now generally looked upon either as analytic definitions (meaning analyses), or as explications, or, finally, as hypothetical statements about the objects in question.

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JOHANNES DÖLLING

Definition II: Rules of Definition

In the older Aristotelian logic a definition is the delimitation of a species by stating the genus which includes it and the specific difference or distinguishing characteristic of the species. A typical example is the definition of man as a rational animal. The genus is the animal genus and the distinguishing characteristic is rationality. The most important classical texts on definition are to be found in Aristotle's *Posterior Analytics* and *Topics*.

A traditional definition *per genus et differentiam* is often called a *real* definition because it is said to characterize the essence of a species. The kinds of definition common in mathematics, that is, definitions which introduce a new symbol, are often called *verbal* or *nominal* definitions. However, it is not clear how a sharp distinction between the two kinds of definition can be made. For our purposes, it is sufficient to understand that a definition is a statement which establishes the meaning of an expression. The definition accomplishes this by relating the expression it defines to other expressions already available.

At least two questions immediately arise from this vague statement about what definitions are. What is meant by 'other expressions already available'? What restrictions, if any, are there on the logical form of sentences which may serve as definitions? The answer to the first question is that we have in mind the introduction of a definition within a specified theory, like the elementary theory of arithmetic. As understood here, a *theory* is characterized in terms of its primitive, non-logical symbols and its axioms. The second question is answered by giving rules of definition, which are illustrated later.

Although the theory of definition to be outlined here is a part of modern logic and has only been developed in this century, the texts of Aristotle mentioned earlier contain much good advice about formulating definitions in more informal contexts which do not assume an explicit theory as background.

The first definition in a theory is, then, a sentence of a certain form which establishes the meaning of a new symbol of the theory in terms of the primitive symbols of the theory. The second definition in a theory is a sentence of a certain form which establishes the meaning of a second new symbol of the theory in terms of the primitive symbols and the first defined symbol of the theory; and similarly for subsequent definitions. The point to be noted is that the definitions in a theory are introduced one at a time in some fixed sequence. Because of this fixed sequence we may speak meaningfully of *preceding* definitions in the theory. Often it is convenient to adopt the viewpoint that any defined symbol must be defined in terms only of the primitive symbols of the theory. In this case there is no need to introduce definitions in some fixed sequence. However, the common mathematical and scientific practice is to use previously defined symbols in defining new symbols; and to give an exact account of this practice, a fixed sequence of definitions is needed.

From the standpoint of the logic of inference, a definition in a theory is simply regarded as a new axiom or premiss. But it is not intended that a definition shall strengthen the theory in any substantive way. The point of introducing a new symbol is to facilitate deductive investigation of the structure of the theory, but not to add to that structure. Two criteria which make more specific these intuitive ideas about the character of definitions are that:

1. a defined symbol should always be eliminable from any formula of the theory, and
2. a new definition does not permit the proof of relationships among the old symbols which were previously unprovable, that is, it does not function as a creative axiom.

(These two criteria of eliminability and non-creativity were first introduced explicitly by the Polish logician S. Leśniewski 1929.) For instance, in arithmetic we introduce the symbols for subtraction by the equivalence:

(1) $x - y = z$ if and only if $x = y + z$.

We may use (1) to eliminate any occurrence of the subtraction symbol. Thus by virtue of (1) we eliminate '$-$' from:

If $y \neq 0$ then $x - y \neq x$,

and obtain the arithmetically equivalent statement:

If $y \neq 0$ then $x \neq y + x$.

It seems reasonable to require that any definition introducing a new symbol may be used to eliminate all subsequent meaningful occurrences of the new symbols. To be eliminable is a characteristic property of a defined symbol, as opposed to a primitive symbol. The concept of eliminability is formalized as follows, where *iff* is an abbreviation for *if and only if*:

Criterion of Eliminability. A statement S introducing a new symbol of a theory satisfies the criterion of eliminability if and only if: whenever S_1 is a statement in which the new symbol occurs, then there is a statement S_2 in which the new symbol does not occur such that *If S then (S_1 iff S_2)* is derivable from the axioms and preceding definitions of the theory.

The notion of a definition not being creative is formalized in the following statement:

Criterion of Non-creativity. A statement S introducing a new symbol of a theory satisfies the criterion of non-creativity if and only if: there is no statement T in which the new symbol does not occur such that *If S then T* is derivable from the axioms and preceding definitions of the theory but T is not so derivable.

In other words, we cannot permit a statement or formula S introducing a new symbol to make possible the derivation of some previously unprovable theorem stated wholly in terms of primitive and previously defined symbols. An example of a formula

which does not satisfy this criterion of non-creativity is the second axiom for groups if we consider a more limited theory than that of groups. The single primitive symbol of our theory is the binary symbol 'o' and the single axiom the associative axiom:

(1) $xo(yoz) = (xoy)oz$.

As the first definition of this theory we now propose the following equation introducing the new individual constant e:

(2) $xoe = x$.

However, applying the criterion of non-creativity we reject (2) as a proposed definition in our theory, for from (2) we may derive at once:

(3) $(\exists y)(x)(xoy = x)$.

We note that (3) is a formula whose only non-logical symbol is the primitive symbol of the theory, but it is trivial to find an interpretation showing that (3) cannot be derived from (1). Thus (2) is creative and must be rejected as a proper definition.

It should be noticed that a special consequence of the criterion of non-creativity is the criterion of relative consistency. If the axioms and preceding definitions are consistent and if a statement introducing a new symbol may be used to derive a contradiction, then the new statement does not satisfy the criterion of non-creativity.

In theories stated in precise language (whether the subject matter is pure mathematics or science), we ordinarily introduce three kinds of defined symbols: relation symbols, operation symbols, and individual constants. We consider here only the rules for introducing relation symbols. (A detailed but elementary treatment is to be found in Suppes 1957, Chapter 8.)

In dealing with definitions, which are ordinarily equivalences or identities, it is customary to introduce the new symbol on the left side and to call this side the *definiendum* (thing to be defined). The right side is called the *definiens* (thing defining).

Rule for Defining Relation Symbols. An equivalence D introducing a new n-place relation symbol R is a proper definition in a theory if and only if D is of the form $R(v_1, \ldots, v_n)$ iff S, and the following restrictions are satisfied: (i) $v_1, \ldots, v_n$ are distinct variables; (ii) S has no free variables other than $v_1, \ldots, v_n$; and (iii) S is a statement in which the only non-logical constants are primitive symbols and previously defined symbols of the theory.

The *definiendum* $R(v_1, \ldots, v_n)$ is an atomic formula, which form is needed to guarantee elimination of the defined relation symbol from every possible context. Some examples will help clarify the three restrictions on the rule. The requirement that the variables $v_1, \ldots, v_n$ be distinct prevents definitions like:

(4) $R(x,x)$ if and only if $x \div x \leqslant 1$.

Formula (1) does not really define the binary relation symbol R, since only one variable occurs in the *definiendum*. With (1) at hand, we would not know how to eliminate R from the statement 'if $R(x,y)$ then $x \leqslant y$'. The *definiens* of (1) must be regarded as defining a unary relation symbol, which is a trivial universal property possessed by every number $x \neq 0$.

The second restriction prevents definitions like:

(5) $R(x)$ if and only if $x + y = 0$.

When (5) is added to the axioms of arithmetic we may derive a contradiction. The source of the trouble is the appearance of the variable y in the *definiens* but not in the *definiendum*, for (5) is logically equivalent to the pair of statements:

(6) If $x + y = 0$ then $R(x)$,
(7) If $R(x)$ then $x + y = 0$.

But from the logic of quantifiers we know that (6) is equivalent to:

(8) If there is a y such that $x + y = 0$ then $R(x)$,

and (7) is equivalent to:

(9) If $R(x)$ then for every y, $x + y = 0$.

From (8) and (9) we immediately infer the false statement:

(10) If there is a y such that $x + y = 0$ then for every y, $x + y = 0$.

(Note that the variable x is left free in this discussion, since it appears in a proper manner in both the *definiendum* and *definiens* of (5).)

The third restriction simply prohibits two kinds of circularity of definition. We could not admit as a proper definition:

(11) $R(x)$ if and only if $R(x)$;

a logical truth such as (11) would not be creative. Its defect is that it does not satisfy the criterion of eliminability. Of a similar sort is the pair of equivalences:

(12) $R(x)$ if and only if it is not the case $P(x)$,
(13) $P(x)$ if and only if it is not the case $R(x)$.

If we define the relation symbol R in terms of the new relation symbol P, and vice versa, then we are not able to eliminate either in favour of the primitive notation.

Padoa's Principle and Independence of Primitive Symbols. When the primitive symbols of a theory are given, it is natural to ask if it would be possible to define one of them in terms of the others. The Italian logician Alessandro Padoa (1868–1937) formulated (1902, 1903) a principle applying the method of interpretation which may be used to show that the primitive symbols are independent, that is, that one may not be defined in terms of the other. The principle is simple. To prove that a given primitive symbol is independent of the remaining primitives, find two interpretations of the axioms of the theory such that the given primitive has two different interpretations and the remaining primitive symbols have the same interpretation. (Theoretical justification of this principle was first given in Tarski 1935.) For instance, consider the theory of preference based on the primitive relation symbols P (for strict preference) and I (for indifference). The axioms of the theory are:

A1. *If* xPy and yPz, *then* xPz.
A2. *If* xIy and yIz, *then* xIz.
A3. *Exactly one of the following:* xPy, yPx, xIy.

We want to show that P is independent of I, that is, cannot be defined in terms of I. Let the domain of interpretation for both interpretations be the set $\{1,2\}$. Let I be interpreted as identity in both cases. In one case let P be interpreted as $<$ and in the other case as $>$. In the first interpretation we have: $1\ P\ 2$ since $1 < 2$, and consequently by Axiom A3 not $2\ P\ 1$.

But in the second interpretation, we have: $2\ P\ 1$ since $2 > 1$.

Now if P were definable in terms of I then P would have to be the same in both interpretations, since I is. However, P is not the same, and we conclude that P cannot be defined in terms of I. E. W. Beth (1953) proved the converse of Padoa's principle for theories formulated in first-order logic, namely, if two models of the sort described above for proving a concept independent do not exist, then the concept is explicitly definable.

Conditional Definitions. In many situations the rules of definition, illustrated above for the case of relation symbols, are too severe. The reason is that many significant defined concepts have an intended natural meaning only when some hypothesis is satisfied. A familiar example is the definition of division in arithmetic.

If $y \neq 0$, *then* $x/y = z$ *if and only if* $x = y \cdot z$.

The main disadvantage of such conditional definitions is that they do not fully satisfy the criterion of eliminability, for instance, in the case of division when $y = 0$. But, with the obvious modifications in the rules of definition, such definitions do satisfy eliminability whenever the hypothesis of the conditional definition is satisfied.

A historically important application in philosophy of such conditional definitions was given in Rudolf Carnap's concept of a *reduction sentence* (1936). Such sentences

were introduced to provide a method of relating dispositional predicates to directly observable predicates. For example, *if x is placed in water, then x is soluble in water if and only if x dissolves.*

In general, the kinds of questions about axioms of a theory that are standard, e.g., whether the axioms are mutually independent, can be reflected in corresponding questions about the primitive concepts of a theory. To give just one more example, the axioms of a theory are *categorical* if any two models of the theory are isomorphic. Tarski (1935) defined the primitive concepts of a theory as *complete* if there is not another set of axioms that:

1. use additional primitive concepts,
2. are categorical, and
3. characterize an essentially richer theory.

Both Euclidean geometry and the elementary algebra of the real numbers are categorical theories, but only the second is complete in its primitive concepts.

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PATRICK SUPPES

Democritus. See: **Atomism I**

Denominatio Intrinseca/Extrinseca

An intrinsic denomination of a thing is a reference to it through some intrinsic and real features of it, the loss or variation of which would determine a real mutation in the thing itself. To refer to a man as 'animal', i.e. by means of essential features, would be a typical case of intrinsic denomination. Intrinsic denomination may, however, also arise from internal accidents, for example when we refer to a swan as white. We have an extrinsic denomination, on the contrary, when we refer to a thing, rather than through its inherent forms or features, by means of some relation or *habitudo* it has toward something else – e.g. toward the perceiving subject. A purely extrinsic denomination does not really affect the thing denominated, and may be lost without any intrinsic mutation of it. In this way, we say of something, e.g. a wall, that it is 'seen' or 'known'.

While these general features of the division between intrinsic and extrinsic denominations were roughly common to all scholastic philosophers, different positions were held on the actual distribution of specific predications in the two fields, and on the logical grounds for it. Usually, Aristotle's table of categories was referred to, and there was some agreement on the opinion that the last six categories (*actio, passio, quando, ubi, situs, habitus*) were all forms of extrinsic denomination. This view was that of Thomas Aquinas (Krempel 1952, pp. 426–32ff.), and we find the same opinion, e.g., in Peter of Fonseca, while Francisco Suárez opposes it (with the exception of the category of *habitus*) by stressing the character of intrinsic modification pertaining to accidents (Doyle 1984, pp. 137–43).

The difference in positions we find with respect to the category of relation is of great interest. Relations were perceived to be relevant for the distinction between intrinsic and extrinsic denominations from a two-fold point of view: on the one hand, there was the problem of whether relations were all to be considered as forms of extrinsic denomination; on the other, that of whether all forms of extrinsic denomination were to be considered as relations, or at least as

grounded on relations, as the theory of the *habitudo* seemed to suggest.

While the reduction of relations to mere extrinsic denominations seems a consequence of Albert the Great's position (Krempel 1952, pp. 82–3), Thomas Aquinas (e.g. *Cont. Gent.* II 13) and later Suárez (*Disp. Met.* d. 47 s. 1,2,11) did not accept this view (Doyle 1984). Suárez, who discussed this problem at length, distinguished the case of 'real' extrinsic denomination, for which the presence of a real relation (*habitudo*) is required, from extrinsic denominations, which are simply the result of our activity as cognitive subjects. An example of this latter case is the conventional imposition of names, in all the contexts in which it only depends upon our arbitrary choice. Real extrinsic denomination, on the other hand, is by no means a purely conventional matter of names, or a fictitious product of our cognitive activity. On the contrary, it is grounded in a "*habitudo realis unius rei ad alia*" (*Disp. Met.* d. 54 s. 2); this real relation provides the grounds for the extrinsic denomination, but is not reducible to it (*Disp. Met.* d. 47 s. 2). According to Suárez, then, real extrinsic denominations are something different from mere *entia rationis*. In this way, he opposes the widespread opinion – which we find, e.g., in Gabriel Vasquez (1549–1604) and John of St. Thomas (1589–1644) – according to which all extrinsic denominations were to be conceived as *entia rationis* (Beach 1965).

The extreme vitality of the discussion on intrinsic and extrinsic denomination in the late scholastic and post-scholastic period may partly be attributed to the relevant role that such a discussion played in theological controversies. Different views were held, e.g., on the problem of whether the sacraments are to be considered a form of intrinsic denomination, i.e. on whether through the sacraments a real, intrinsic modification of the soul is brought about.

The problem of the connection between extrinsic denominations and relations is of particular interest in the case of Leibniz. The well-known Leibnizian claim according to which there are no purely extrinsic denominations has been considered equivalent to the thesis that all relations – or relational predicates – are reducible to non-relational properties. It should be stressed that Leibniz's positions in this regard are to be read with the late scholastic background of the debate in mind. Suárez's claim according to which all 'real' extrinsic denominations are grounded on reality (on real relations) may be connected in this way with Leibniz's thesis that relations, if considered as real (as accidents), are not something 'external' to the things being related, and if considered as external, are not something real (are neither substances nor accidents, but a mere ideal thing).

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GINO RONCAGLIA

Dependence

There are many ways in which something is said to depend on something else: psychologically, physiologically, economically, politically, causally, etc. When quantities vary with one another we speak of functional dependence. We are concerned here only with ontological dependence. Something is ontologically dependent on something else when the first cannot exist unless the second exists. This formula can be specified in different ways. We have individual dependence when the things in question are individuals. A headache is dependent in this sense on the particular person whose head it is that aches. An individual may be generically dependent on a kind, if it cannot exist unless some member of this kind exists. A human being cannot exist without carbon atoms, but which carbon atoms exist is not thereby determined.

Ontological dependence of either sort must be distinguished from mere notional dependence. Husbands are notionally dependent on wives in this sense, in that no one can be a husband unless someone else is a wife, but no man who is a husband is ontologically dependent on a woman who is a wife. The difference between concepts of notional and true ontological dependence can be brought out by means of analyses employing model operators:

Notional Dependence of F on G:
$\Box\,(\exists x Fx \rightarrow \exists y Gy)$
Generic Dependence of a on G:
$\Box\,(\mathrm{E}!a \rightarrow \exists y Gy)$
Individual Dependence of a on b:
$\Box\,(\mathrm{E}!a \rightarrow \mathrm{E}!b)$.

We shall concentrate in what follows on individual dependence. The definition of individual dependence just given, that of *weak foundation*, admits numerous trivial cases, which are ruled out in the more useful definition of:

Weak Rigid Dependence of a on b:
$\Box\,(\mathrm{E}!a \rightarrow \mathrm{E}!b) \;\&\; a \neq b \;\&\; \sim \Box\,\mathrm{E}!b$.

Weak rigid dependence includes the case of essential parts: if an object cannot exist unless another object exists and is part of it (as a particular helium atom cannot exist unless its particular protons exist and are parts of it) the parts are essential to the whole.

A stricter notion of dependence requires the object on which something depends not to be part of the dependent object, so dependence literally goes outside the dependent object. That gives us:

Strong Rigid Dependence of a on b:
$\Box\,(\mathrm{E}!a \rightarrow \mathrm{E}!b) \;\&\; \sim (b < a) \;\&\; \sim \Box\,\mathrm{E}!b$.

A helium atom is not thus dependent on its protons, but a headache is thus dependent on its bearer.

Ontological dependence of various kinds has been central to ontological discussion since Plato, for whom individuals depend on universals, and Aristotle, for whom accidents depend on substances. Ontological importance attaches to objects which are absolutely independent, ranging from Aristotelian substances to the philosophers' God. The notion of dependence involved may vary. Thus by defining substance in terms of weak rigid dependence, we can arrive at Leibnizian monads (since Leibniz thought that all parts are essential to their wholes), while defining it in terms of strong rigid dependence can yield Spinoza's *deus sive natura*. Despite its importance, the topic of dependence has rarely received explicit treatment. The most influential modern discussion is in Edmund Husserl's third *Logical Investigation*. Otherwise the topic has been unjustly neglected by ontologists, especially those in the analytic tradition.

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PETER M. SIMONS

Descartes, René

René Descartes was born in the French town of La Haye (now called 'Descartes') on 31 March 1596, and died in Stockholm, Sweden, on 11 February 1650. Although he had a traditional scholastic education at the celebrated Jesuit college of La Flèche, he is properly called the father of modern philosophy, for it is he, more than any other philosopher, who displaced metaphysics and ontology from their place of eminence, in favour of epistemology. It was Descartes whose thought inspired the great rationalists, Spinoza and Leibniz, and the school of avowed Cartesians includes men of genius like Antoine Arnauld (1612–94) and Nicolas Malebranche (1638–1715).

Descartes's major works include the *Discourse on Method* (1637) and accompanying essays illustrating his method, and the *Principles of Philosophy* (1644) which is a systematic presentation of Cartesian metaphysics

and natural philosophy. With such writings Descartes led the modern philosophers' rebellion against the metaphysical tradition that depicted the universe as a hierarchy of natural kinds culminating in the supreme being, God, and which partitioned the sciences likewise, according to the genus of beings studied, in an isomorphic hierarchy culminating in theology. But Descartes's rearrangement of this traditional picture is most artfully accomplished in his philosophical masterpiece, the *Meditations on First Philosophy*, first published in 1641 together with five (and then in 1642 with seven) sets of objections by noted thinkers and replies by the author. The comments on Descartes's metaphysics which follow are based mainly on this text.

There were, of course, precedents for Descartes's philosophical rebelliousness. As a physicist and a mathematician, he was well aware of the alternative to Aristotelian physics and celestial mechanics proposed by Galileo, and of the militant opposition given it by scholastically trained authorities. As a student of the Jesuits he must have been aware of the issues of Reformation and Counter-Reformation. Finally the ancient sceptical teachings, recorded by Sextus Empiricus (*c.* 150–*c.* 225), had been popularized half a century earlier in the vernacular essays of M. E. de Montaigne (1533–92). Whether such examples of intellectual unrest were motives for Descartes or merely point to a common cause cannot here be determined. In any case, he saw more clearly than most of his contemporaries, and more deeply than any of his rivals, the direction that modern philosophy would have to take to adjust itself to the rising importance of the reformed natural sciences in a climate of general scepticism. Not the least merit of the *Meditations* is their tactfulness. Without forgetting the urgency of reawakened scepticism, with which *Meditation* I begins, the title word 'meditation' yet suggests the Jesuit 'spiritual exercises', holding out the hope of insight as the reward of labour. The ideal meditator must be someone 'completely free of prejudice and able to withdraw from commerce with the senses' (AT VII, 4, 28f.). Such a person will realize that what is commonly held to be certain is dubitable in some degree and will find indubitable only what he perceives 'clearly and distinctly'. And Descartes will establish as a general rule that whatever is clearly and distinctly perceived is *true* (*Med.* III, AT VII, 35, 14f.).

On the basis of this general rule, then, the 'fluctuating testimony of the senses', which had been the starting-point of traditional metaphysics, can be disqualified. In the famous 'wax experiment' of *Meditation* II Descartes shows how all the sense-related properties of a ball of wax – its colour, taste, texture, etc. – are altered when it melts. Yet it remains numerically the same wax. Thus the body is not that which we knew confusedly by the senses, but that which we can perceive clearly by the understanding – its extension, flexibility, and mutability. By these Descartes intends a perfectly general, philosophical notion of volume and shape. The latter two, together with motion, are the fundamental properties by which the new mechanistic physics sought to understand all physical phenomena, and to which it attempted to reduce them. So, in the wax experiment we get an excellent example of what Descartes meant when he wrote to Mersenne (28 January 1641):

> . . . I shall tell you, just between ourselves, that these six Meditations contain the whole foundation of my Physics. . . I hope that readers will slowly become accustomed to my principles before realizing that mine destroy those of Aristotle. (AT III, 297, 31–298, 7.)

The ideal of extending geometrical reasoning to every domain of enquiry was central to Descartes's plan for reform of the sciences (cf. *Discourse on Method* II, AT VI, 19, 6–17). Passages like the one concerning the wax experiment show that this ideal may be at work beneath the surface, even where the discussion nominally concerns traditional metaphysics. By Descartes's method one is able to 'discover' the fundamental nature of body to be geometrical extension, and of the physical world to be the clockwork interaction of parts of extension, whose only motion is local motion. Hence Cartesian nature, like that of Galileo, is a universal mechanism best described in the language of mathematics.

According to Descartes, however, we cannot make this fundamental discovery about nature until we have made a prior subjective discovery about our own existence, as thinking things. The certainty of my own existence, which is clearly and distinctly evident to me while I exercise doubt (or any other mode of thought) is logically the first clear and distinct deliverance of reason. It also provides the standard of clarity and distinctness by which all subsequent inferences may be judged. The famous words, *cogito, ergo sum*, stand, at least implicitly, at the beginning of every enquiry. Thus all the objective discoveries about the external world presuppose subjective ones about the mind, its existence, and nature. And these would remain unshaken even if all the doubts of the sceptics concerning the external world were true. The logical priority of the subjective brings with it the methodological priority of epistemology over metaphysics, which has been a characteristic of modern thinking since Descartes.

But this new dependency had its own problems. The thinking subject (*res cogitans*) is totally different from its object, the bodily world (*res extensa*). Mind is thinking, but unextended. Body is extended, but unthinking. Probably the most serious shortcoming of the Cartesian philosophy was its failure to provide any clear account of how mind and body could interact. Descartes often said that the mind moved the body as heaviness moves a stone, apparently unaware that such a conception of mind was as untenable as the physics from which the analogy was drawn. The unresolved problem of psychophysical dualism was one of the chief legacies of Descartes. Malebranche's 'occasionalism', Spinoza's 'monism', and Leibniz's 'monadism' are all attempts to overcome it. So also are many subsequent and unsuccessful versions of materialism and idealism, that have tried to cut the Gordian knot by doing without one or the other of Descartes's two principles.

Descartes also exercised a profound influence on the erstwhile centre of metaphysics – theology. For his own part he avoided theological issues as much as possible, but leading theologians of his day saw in his philosophy the ideal remedy to stem the rising tide of materialism, atheism, and libertinism. In the words of his contemporary, Arnauld, the philosophy of Descartes was:

> a singular effect of the Providence of God, who wished to end the frightful penchant of many people these days toward irreligion and libertinism by a method suited to their disposition (Antoine Arnauld, *Oeuvres*, v. 38, p. 136).

Descartes was able, it seemed, to defend major religious truths (the existence of God and the immateriality, hence possible immortality, of the soul) on grounds acceptable to secular or even atheistical thinkers. The great 17th-century shift in Christian apologetics from Christology to philosophical theology was hastened, if not occasioned, by the thought of Descartes.

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Determinate/Determinable

The distinction between determinates and determinables was introduced by the logician W. E. Johnson, who refers to the contrast between *mode* and *attribute* in Descartes and Spinoza. Johnson's distinction is one among what he calls 'adjectives' in a non-grammatical sense, i.e. among properties and relations. Adjectives characterize things or (if they are relations) thing-couples *more or less determinately*, more or less specifically. Red, e.g., is less determinate than carmine. If one compares and orders adjectives with regard to their determinateness, one does not arrive at a series with a single least determinate adjective, but at several trees whose roots are all least determinate or maximally unspecific. These adjectives are the deter-

minables and the others the determinates. Examples of determinables are colour and shape, or rather: coloured and shaped. Adjectives comparable in respect of their determinateness, i.e. adjectives belonging to the same tree, are collected by the respective determinable, they are determinates *of* this determinable.

Johnson concedes that words such as 'colour' stand also for classes of determinates of the same determinable, for example in sentences such as 'Red is a colour'; here there is a similarity to generic names such as 'man' as they figure in sentences such as 'Plato is a man'. He insists, however, that while the class of men is defined by common properties, the class of colours is not, so that the former sentence, unlike the latter, is not equivalent to a property predication. Thus Johnson considers determinables not as adjectives of, but as adjectives on the same level as, the associated determinates. This is an important point in Johnson's doctrine since he assumes that the characters of things are absolutely determinate, so that only the tops of the trees, i.e. the maximally specific adjectives, appertain to things. All other adjectives arise from the indeterminateness of our *thinking* of these characters. Hence the determinable adjectives too must be derivable from the latter.

That Johnson chose the expression 'determinable' rather than 'indeterminate' has to do with his view of predication. To be characterized by a certain adjective, a thing must first be the kind of thing that can have this adjective, which is the case if it is characterized by the respective determinable. A surface has colour, a dream has not. The former can be red, the latter cannot. A surface is determinable with respect to colour, a dream is not so determinable; it cannot have any of the determinates of the determinable colour.

Whatever one's opinion of Johnson's ontology and theory of knowledge, one cannot deny his merit of having drawn attention to property kinds, where philosophers mostly deal with single properties. Johnson shows, moreover, that we are confronted with determinables in many contexts: in comparison they are the *respects* in which things are comparable; they are the *fundamenta divisionis* of classification and the bases of incompatibilities between properties, they are involved in causation and dependence as *factors* and they are the ranges of substitutions which occur in change.

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ERWIN TEGTMEIER

Determinism

The formation of the word 'determinism' and the role it has played in philosophy clearly imply that 'determinism' must be understood as the thesis that the past and the laws of nature *determine* a unique future. That is to say: if A is a proposition that completely describes the momentary state of the world at a certain time, and B is a proposition that completely describes the state of the world at some later time, and if L is the conjunction into a single proposition of all laws of nature, then the conjunction of A and L entails B. (Many philosophers would hold that if the past in this way determines a unique future, the future in the same way determines a unique past: that the conjunction of B and L entails A.) The problem of defining 'momentary state of the world' and 'law of nature' is generally conceded to be of very great difficulty.

It is this idea of determinism that underlies the famous image of Pierre Simon de Laplace (1749–1827), an image of a vast Intelligence who is able mathematically to derive the state of the universe (the position and momentum of every particle of matter) at any time, given its state at any earlier time. But the possibility of such a calculation is not entailed by the above definition, even given the existence of the Intelligence and the classical conception of 'state', for the fact that p entails q does not imply that q is mathematically derivable from p. Nevertheless, determinism in the present sense is often referred to as Laplacian determinism. Other statements or definitions of determinism – e.g., that every event has

cause – must be regarded as adequate only if they are equivalent to 'Laplacian' determinism (hereinafter called 'determinism').

The denial of determinism is *indeterminism*. Indeterminism may be thought of as the doctrine that the laws of nature are sufficiently 'loose' that at some moments they allow the history of the physical universe to 'fork', to go on in either of two incompatible ways.

Three sorts of consideration have been appealed to in attempts to establish the truth or the falsity of determinism. First, it has been argued that it can be shown *a priori* that determinism is true, since, if determinism were false, some events or facts would lack an explanation; and this, it is held, would be a violation of the Principle of Sufficient Reason. Secondly, it has been argued that empirical science has discovered, or by its success demonstrated, or presupposes, the truth of determinism; and it has also been argued that empirical science has discovered that determinism is false. Thirdly, it has been argued that human free will requires indeterminism.

An appeal to the Principle of Sufficient Reason for this or any other purpose would seem to be of doubtful value, since there are no clear statements of this 'principle'. The scientific status of determinism is a matter of intense and highly technical controversy. It is, however, probably correct to say that current physics endorses indeterminism, and that it is very hard to see how any future developments in physics could lead to a withdrawal of this endorsement.

The body of philosophical controversy about determinism has to do with the relation between determinism and *free will*. An agent is said to have free will if he can (is able to, has it within his power to) act differently from the way he in fact acts. Thus a certain person's lie was an act of free will if that person, instead of lying, could have told the truth (was able to tell the truth, had it within his power to tell the truth). The words 'free will' are a misleading name for the power to do otherwise, but they have no generally recognized alternative.

Determinism is linked with free will in the history of philosophy because of the famous 'problem of free will and determinism'. The problem can be posed as a dilemma: if determinism is true, one has no free will, since one's acts are determined by events in the remote past, which one obviously has no control over; on the other hand, if determinism is false, one has no free will, since undetermined events are due entirely to chance, and chance events are outside anyone's control. There is, therefore, no free will (and, presumably, no moral responsibility).

Most of the great philosophers who have written on this problem have rejected the first horn of the dilemma. Such philosophers are called *compatibilists* because they hold that free will and determinism are compatible. Thomas Hobbes, David Hume, and John Stuart Mill are compatibilists. Kant and Jean-Paul Sartre are perhaps 'incompatibilists', although it is doubtful whether either was addressing 'the problem of free will and determinism' as it is here formulated.

Compatibilists generally argue that 'free will' is a dispositional causal power, like fragility or solubility, and that it can therefore exist in a wholly determined world. (A pane of glass could be fragile even if it could be foreseen by the Laplacian Intelligence that nothing would ever strike it, and thus that it would never break.)

Incompatibilists argue their case first by carefully elaborating the argument that, if determinism is true, one has no free will, owing to the fact that one's acts are determined by factors over which one has no control, and, secondly, by attacking the thesis that free will is a dispositional causal power. If they believe in free will – not all incompatibilists do – they may also attempt to explain how an agent could have a choice about the outcome of a causally undetermined process.

The debate between the compatibilists and the incompatibilists shows no sign of resolution. Therefore, even if it could be conclusively demonstrated that human beings had free will, this would not constitute a generally accepted demonstration of indeterminism.

Many of the technical terms employed in this article have been used in more than one sense. Some philosophers have regarded in-

compatibilism as so obviously true that they have used 'determinism' to mean the conjunction of determinism (as the term is used in the present article) and incompatibilism. This usage is now avoided by careful writers. It was William James who introduced the widely used terms 'hard determinism' and 'soft determinism'. Hard determinism is the conjunction of determinism and incompatibilism. Soft determinism is the conjunction of determinism and compatibilism.

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PETER VAN INWAGEN

Dialectics: I: Dialectical Argument

Aristotelian dialectic has at least two necessary characteristics:

1. the form of the method is question and answer (*Top.* 155b7–16),
2. the argumentation employed in the method is "from accepted opinions" (ἔνδοξα) (*Top.* 100a29–b22).

At *Topics* 100a18–24 the grand aim of the method is said to be to argue about any problem whatsoever without falling into contradiction. Later in the *Topics* the scope of the method is limited to debate of dialectical problems, i.e. problems which evoke controversy or about which the majority and the wise have no opinion (*Top.* 104b1–5). That there are no boundaries to the problems which dialectic treats remains none the less a characterization of dialectic in Aristotelian works (*Soph. El.*, 172a9–15; *Post. An.* 77a26–35).

The connections and distinctions between dialectic and metaphysics have been matters of dispute. The disputes centre around how to distinguish metaphysics from dialectic, and how dialectic applies to metaphysics in the investigation of the first principles of metaphysics, particularly the proof of the Principle of Non-Contradiction at *Metaphysics* 1006a18–1007b18.

One view on the distinction between dialectic and metaphysics, originally proposed by G. E. L. Owen (1960), is that dialectic is a method which pertains to Aristotle's earlier thought in the *Organon* and not strictly to his later thought in the middle book of the *Metaphysics*. In the *Organon*, Owen argues, Aristotle holds that a general science of being which transcends the special sciences is impossible because 'being' is not predicated univocally but applies to different subjects in different ways; dialectic, on the other hand, is a method with sufficient generality to treat any problem in any science, but 'reasoning' in dialectic proceeds from opinion not knowledge, so any conclusion to dialectical reasoning can only be accepted as tentative. In Books IV, VI, and VII of the *Metaphysics* Aristotle introduces and applies the notion of 'focal meaning' to 'being' which explains how various senses of 'being' depend upon the primary sense, namely substance, but avoids the consequence that 'being' is predicated univocally of its subjects. At this later stage in Aristotle's thought the role of dialectic as the only discipline which transcends the sciences is usurped, and it becomes an auxiliary discipline to metaphysics.

J. D. Evans (1977) has stressed that in both the *Organon* and the *Metaphysics* Aristotle gives a consistent account of the connections and distinctions between dialectic and the sciences, including the science of being *qua* being. Evans claims that Aristotle consistently views dialectic as a method whose employment allows one to move beyond a pre-scientific use of the faculties, i.e. a use which concerns reasoning from the beliefs of specific people or a group to the scientific use of the faculties, a use which concerns reasoning from knowledge. (Propaedeutical characterizations of dialectic have been given also by Michael F. Burnyeat (1981) and M. C. Nussbaum (1982) concerning the possible role of dialectic in coming to the 'understanding' of universal truths.) But dialectic is 'ontologically neutral' even in this latter employment, because dialectic makes no unqualified attempt to investigate the nature of being or anything else.

Whether or not we accept Evans's or Owen's view on the role of dialectic in the

development of Aristotle's thought, to characterize Aristotelian dialectic as 'ontologically neutral' or as 'a method distinct from metaphysics' does not do justice to the many metaphysical assumptions of the method of the *Topics* (and here the distinction between ontology and metaphysics and how these notions apply to Aristotle's thought should be kept in mind (see J. Owens 1986): the *topoi* themselves, numerous rules and strategies for how to 'construct' and 'destruct' dialectical arguments (*Top.* II–VII) are based upon the theory of the five predicables: definition, species, genus, property, and accident. The predicables presuppose an essence/accident distinction, a distinction between predicates which belong to or signify the 'what is it' of a subject and those which do not. Moreover, the theory of the five predicables is explicitly located within the theory of the categories (*Top.* 103b1–19). This implies that the traditional ontological scheme of the *Categories*, the ontological square, is a presupposition of dialectic, though Aristotle does not elaborate on this. It may be the case that in the *Topics* the possibility of the science of being *qua* being is not envisioned, but the method of the *Topics* has its foundation in a rather explicit view of how reality is structured.

If we consider how dialectic applies to the study of metaphysics then the primary text is the 'elenctic proof' of the PNC (Principle of Non-Contradiction) in *Metaphysics* 1006a18–1007b18 (by 'elenctic proof' Aristotle means 'dialectical proof'). Numerous commentators, ancient and modern, have puzzled over this text (see Łukasiewicz 1979). Among the more recent, it is T. H. Irwin who claims that Aristotle intends his proof to produce non-demonstrative knowledge of the PNC. According to Irwin, the application of dialectic in the proof involves argument from premisses which no interlocutor can rationally deny, premisses essential to reasoning itself. Thus such a proof of the PNC, although non-demonstrative, yields knowledge of the PNC, and stands as an example of how a first principle can come to be known without the exercise of the intuitive intellect (νοῦς). A. Code (1986) has recently argued that Irwin mistakenly thinks that Aristotle intends to prove the PNC by the elenctic proof (besides, Code points out that the proof employs semantical and metaphysical assumptions which cannot be considered rationally irrevocable). Code suggests that Aristotle merely intends to prove things about the PNC. By this he means that the elenctic proof does not stand as a demonstration that the PNC is true but provides reasons *why* the PNC is true to someone who already accepts *that* it is true (e.g. the PNC is necessary for significant speech and thought).

There is no textual support in the *Topics* for the kind of use for dialectic Irwin proposes. Code, however, can maintain that the elenctic proof is an example of how dialectic can be used in the investigation of the first principles of a science, a use for dialectic mentioned at *Topics* 101a27–101b4.

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DONALD FELIPE

Dialectics
II: Dialectics and Inconsistency

The word 'dialectics' has been employed to convey quite different meanings. Its pristine

sense, especially in Plato's work, was the method of doing philosophy by exchanging questions and answers. Aristotle in the *Topics* understood dialectics as an art of reasoning subject only to constraints enforcing plausibility rather than cogency, the latter pertaining to logic proper. Later on, though, 'dialectics' came to mean just logic, and it was in that sense that the word was used through most of the Middle Ages and the Renaissance.

The nowadays prevailing sense of 'dialectics' somehow, if in a roundabout way, originates with Kant, for whom *dialectics* was the study of the ideas of pure reason in their transcendental usage, that is to say when they are used beyond their merely regulative role and as (purportedly) constitutive concepts, thus being assigned a cognitive status which does not belong to them. One of the divisions of such dialectics was the study of the *antinomies* of pure reason, which are contradictions ensuant upon a transcendental use of the idea of the *world*. This is how the word 'dialectics' came, after Kant and especially in Hegel's work, to mean the disclosing of insurmountable contradictions.

Kant only thought such contradictions are insurmountable insomuch as, owing to a transcendental illusion, people are bent on stretching the use of reason beyond its immanent scope, i.e. on taking it to provide knowledge rather than merely regulative, research-guiding, standards or ideals. Hegel, while agreeing that those antinomies did indeed arise, argued that, for one thing, countless many other contradictions, too, emerge *as true*, and, for another thing, no contradiction is to be avoided – since only some tenderheartedness towards reality debarred Kant from recognizing that the contradictions are in fact present in the real world, instead of being the creation of a purely subjective view of the mind.

Hegel, too, granted that the contradictions are to be overcome, but overcoming or *aufheben*, as he understood it, was by no means the same as dispelling or eliminating; it was conceived of as a process by which that which is overcome is at the same time annulled or cancelled and yet also kept, even enhanced, brought to a higher level. Dialectics is according to Hegel the view, proper to (negative) *reason* as against mere *understanding*, which is able to uncover the contradictions in things. (It is outranked by *speculative* thought, thought which, while also belonging to reason, is positive in that it not just points to or makes out but asserts or recognizes the existence of contradictions in things, even if it also denies it, thus adopting a higher or superior view, which transcends the onesidedness and also the shyness characterizing both understanding and negative reason.)

Such Hegelian views were not precedentless. Forerunners thereof can plausibly be argued to be, e.g., Heraclitus (fl. 500 BC) and Aenesidemus (*c.* 80–40 BC), and also some of Plato's later dialogues, especially *Parmenides* and *Sophist*, as well as a long Neoplatonist tradition, represented mainly by Plotinus (*c.* 205–70), Proclus (*c.* 410–85), the *Areopagiticum Corpus*, John Scottus Eriugena (*c.* 810–77), and, to a lesser extent, Augustine. But the main anticipation of the Hegelian thesis of the contradictoriness of the world is to be found in the work of the latest great Neoplatonist, Nicholas of Cusa, who extolled understanding the coincidence of the opposites in God as the summit of human thought, which he showed to require a new, non-Aristotelian, logic, within which the principle of non-contradiction would be negated, but not rejected – it would incorporate a *copulative* approach, according to which both the *est et non est* and its negation, the *nec est nec non est*, would be asserted and combined into a new kind of speech.

Some post-Hegelian thinkers, especially Marxists, have tried to rescue Hegelian dialectics, while waiving the whole of the Hegelian system as a dross. Although no unanimity has been reached among the interpreters concerning the gist of the dialectical views put forward by authors such as Marx, Engels, and Lenin, they can be cogently argued to have stood by the Hegelian belief in the existence of true contradictions. They are not alone in maintaining such a view. Another school in contemporary philosophy which has also upheld dialectics in the sense of asserting the reality of contradictory truths is the kind of *energetism* espoused by the

Romanian philosopher Stephane Lupasco and his French disciple Marc Beigbeder (see Beigbeder 1972).

Finally, a revival of dialectical thought has been brought about by the construction of *paraconsistent* systems of logic. Thus, e.g., some logicians have alleged that the dialectical principle of the unity of opposites can be regarded as a defensible proposal within a paraconsistent formal framework (Routley 1979, da Costa and Wolf 1980, Rescher and Brandom 1980, Priest 1982).

Likewise, the author of the present article has argued for a dialectical metaphysics which, while agreeing with the Hegelian view that there are contradictory truths, articulates such a view within an entirely different framework, putting forward a *quantitative dialectics* by stressing that true contradictions are always ensuant upon *inbetweenness*, i.e. upon the existence of degrees of existence or truth, which are intermediary between absolute truth and utter falseness. (Non-sentential truth is regarded as nothing else but the existence of states of affairs.)

This dialectical approach – whose thrust is to be regarded as carrying (something akin to) the Leibnizian principle of continuity to its ultimate consequences – has been termed a *contradictorial gradualism* (but also goes by the name of 'ontophantics') and, besides being developed into a comprehensive system of metaphysics and epistemology, has been articulated through a paraconsistent, infinite-valued system of logic, which its author has claimed to be the fulfilment of Cusa's project. By such an articulation, which is still in progress, the system has evolved into an axiomatic (fuzzy) set-theory, with modal, temporal, doxastic, and deontic extensions. It has been suggested to constitute a viable solution to difficulties such as the sorites and a number of paradoxes in those and other areas – e.g. value and duty conflicts in ethics. On the other hand, some critics (e.g. da Costa 1989) have pointed out that the formal system thus constructed is both hard to master or assess and undecidable, and that the philosophical approach is fraught with too heavy ontological commitments.

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LORENZO PEÑA

Dilthey, Wilhelm

Wilhelm Dilthey (1833–1911) was a German philosopher and historiographer. After having studied history, philosophy, and theology (with, amongst others, August Boeckh, Leopold von Ranke, and Friedrich Adolf Trendelenburg), Dilthey became professor at Berlin, moving from there to teach at Basel, Kiel, and Breslau and finally back to Berlin (1882–1905), where he had been called as successor to Rudolf Hermann Lotze. His vast output was made up primarily of studies on the problem of historical knowledge and on the methodological foundations of the *Geisteswissenschaften*. He came to be known as one of the foremost exponents of the hermeneutical tradition and one of the founding fathers of historicism. Dilthey is, however, the author of numerous other essays on ethics, aesthetics, literary criticism, psychology, pedagogy, and, most importantly, historiography.

At the centre of Dilthey's philosophical work, beginning with *Einleitung in die Geisteswissenschaften* of 1883, stands the fundamental problem of a 'critique of historical reason' which addresses itself to defining the subject matter, the conditions of possibility, and the modalities specific to our knowledge of the historical-spiritual world – in much the same way as Kant's first *Critique* had done

for the natural sciences. Where the natural sciences are concerned to explain (*erklären*) facts and events by means of general hypotheses, in the *Geisteswissenschaften* the knowing subject, itself a part of the objective field that it investigates, must understand (*verstehen*) the structures and symbolic relations of human reality. This understanding takes place as it were 'from within' and on the basis of manifestations or expressions of meanings (*Lebensäußerungen*). The latter can be, for example, artistic, cultural, philosophical, moral, religious, political, or institutional.

Dilthey believed that founding a general doctrine of historical understanding called for a *descriptive or analytic psychology* distinct from empirical or physiological psychology. This would investigate the criteria that give order to our understanding of the historical-spiritual world on the basis of an examination of the original psychic unity of the individual human subject (in the three separate but interconnected areas of thought, will, and feeling). He developed this psychological foundation of the hermeneutic process of understanding primarily in his *Ideen zu einer beschreibenden und zergliedernden Psychologie* of 1894.

In his later writings, however, Dilthey assigned an increasingly secondary role to psychology. In its place, he developed and worked out an 'ontology of life'. This had as its object the specific historical nature of life and sought to construct the categories corresponding to the basic ontological structures thereof. *Der Aufbau der geschichtlichen Welt in den Geisteswissenschaften* of 1910 is the fullest statement of his views. In the last stage of his activity (especially in *Das Wesen der Philosophie* of 1907), Dilthey sought also to avoid the collapse of historicism into cultural relativism. Thus he began to reflect on the cultural self-representation of philosophy with the aim of individuating the different basic types of *Weltanschauungen*.

Through his work Dilthey exercised a great influence on contemporary culture. His thought has been taken up above all by thinkers in a historicist vein close to his own (such as Georg Misch, Ernst Troeltsch, Friedrich Meinecke, Eduard Spranger, Hans Freyer, Erich Rothacker), but it has also been critically discussed by phenomenologists (Edmund Husserl, Martin Heidegger), in the philosophy of existence (Karl Jaspers, José Ortega y Gasset), in sociology (Max Weber, Werner Sombart), and in anthropology (Helmuth Plessner). It has recently become an object of study in the context of a renewed interest in hermeneutics, for example in the work of Hans-Georg Gadamer.

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FRANCO VOLPI

Diodorus Cronus

Diodorus Cronus of Iasos in Caria (Asia Minor) was taught by a pupil of Eubulides (4th century BC) named Apollonius Cronus of Cyrene (4th century BC), and was established as a teacher of dialectics in Athens about 310 BC. As shown by D. N. Sedley (1977) he did not die in 307 BC., but was active until about 290 in Athens, and influenced the founders of the three Hellenistic Schools there (Epicurus, Zeno of Citium, and Arcesilaus (*c.* 315–*c.* 240 BC)); he then moved to Alexandria, where he died after 285 BC. An old tradition has it that Diodorus was a member of the Megarian School, and uses this to interpret his tenets. But it is only later that Hellenistic biographers constructed the tradition of a philosophical school founded by Euclid of Megara; and Diodorus too did not belong to the Megarian School proper, i.e. to the circle around Stilpo of Megara (*c.* 380–*c.* 300 BC). Instead he was the most prominent figure of a rival group, the Dialectical School, twelve members of which we know by name, in addition to Diodorus and his pupil Philo (4th century BC) (cf. Giannantoni 1985). This school cannot be

characterized by ontological positions, particularly not by an Eleatic one, but continued discussing by means of yes/no questions, in analogy to Aristotle's concept of dialectic. Accordingly it was especially interested in logic, above all propositional logic. In this respect it also had a great impact on the early Stoics.

In Diodorus' doctrines dialectical interests predominate as well. But what he says about motion and the possible has at the same time some ontological relevance. Concerning the problem of motion he stated that one could not say 'something is moving', but only 'it has moved'. Because of the sharp distinction between imperfect and perfect tenses this thesis shows some promise for a logic of tenses. To prove his statement Diodorus used several arguments, some of which say that neither a space nor even a time could be specified in which motion could take place. These arguments point to a certain difficulty in thinking motion as a mode of being. Other arguments (one of them coincides with one from the first group) are based on the assumption of magnitudes without parts (ἀμερῆ) and render the thesis on motion a contribution to the history of atomism. For with these arguments Diodorus countered an argument of Aristotle, who by reasoning that partless magnitudes were unable to move, tried to refute the idea of a partless body in motion (*Phys.* VI 1, 231b21–232a17; 10, 240b8–241a6).

Of more far-reaching influence were Diodorus' statements on the possible. According to him the possible is that which either is or will be true. To prove this definition, he invented the so-called Master Argument, which was concerned with at least the following three propositions:

(1) Every proposition true about the past is necessary.
(2) An impossible proposition does not follow from a possible one.
(3) There is something possible which neither is nor will be true.

The argument maintained that at least one of these premisses had to be false. Since (1) and (2) are obvious, as Diodorus thought, the negation of (3), i.e. his definition of the possible, follows, from which he determined the other modalities as well. But how, and by which additional premisses, Diodorus formed the argument into a chain of regular syllogisms, is not quite certain. Although the reconstruction by A. N. Prior was of great merit, the discussion has continued. To decide between the various formal possibilities, three additional criteria have been considered: (a) the argument was intended to demonstrate an inconsistency in Aristotle, who had accepted all the premisses (1), (2), and (3); (b) in antiquity it was held to be a deterministic argument; and (c) the most prominent logicians of the 3rd and 2nd century BC accepted its formal consistency. In consequence of (c) those wanting to escape Diodorus' conclusions and – compare (b) – to present a different view about determinism, fatalism, and the free will question, had to challenge the assumptions (1) or (2) or one of the further premisses of the Master Argument. This was done in various ways by Philo, Panthoides (another member of the Dialectical School), Epicurus, Cleanthes (*c.* 300–222 BC), Chrysippus, and Antipater of Tarsus (d. *c.* 130 BC). The famous discussions concerning the concept of true implication belong to this context as well. According to Diodorus, a conditional proposition is true precisely if "it neither was nor is possible for the antecedent to be true and the consequent to be false". Possibly even before Diodorus, Philo defined the concept of true implication in the sense of material implication; and shortly thereafter Chrysippus declared $p \rightarrow q$ to be true if and only if the negation of q is incompatible with p.

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KARLHEINZ HÜLSER

Dispositions

Dispositions are defined by conditionals that say how objects would behave in specified situations. For example, to be water-soluble is to dissolve if put in water. Many mental states are dispositions: to be brave is to be disposed to behave bravely. Dispositions can come by degrees (as these examples show), and can also be statistical: a fair coin is one that is disposed to have equal chances of landing heads and tails if fairly tossed.

The conditionals which dispositions entail make them contentious, especially in the philosophy of mind. Some philosophers think these conditionals are neither true nor false, and hence that dispositions are not real properties. If so, then although supposed mental states like belief and desire may be reduced to the behaviour to which they dispose us, they cannot then cause that behaviour, or be themselves caused, e.g. by perceptions.

Realists about dispositions (see e.g. Armstrong 1968) prefer therefore to identify them with whatever properties (their 'bases') cause the behaviour by which they are defined: e.g. an object's solubility with the property that causes the object to dissolve – a property which is not given *a priori* and which may differ in different soluble objects. Similarly, mental states may be identified with the (e.g. physical) bases that cause the behaviour to which they dispose us: bases that are not deducible *a priori* and which may vary from person to person. These bases may then also interact, and have perceptual causes: a fact that enables simple behavioural definitions of mental states to be expanded into more realistically complex 'functionalist' ones.

Realism about dispositions also underlies 'propensity' theories of chance, which identify a coin toss's chance p of landing heads with whatever property would, if shared by enough tosses, virtually ensure (by the laws of large numbers) that the fraction of heads was close to p. (See Popper in Tuomela 1978.)

Most realists think dispositions need non-dispositional bases: e.g. microstructural properties, or events. But what are these non-dispositional bases? They can't be properties like mass (a disposition to accelerate) or events like accelerations (dispositions to increase velocity). So perhaps all properties are dispositions: i.e. mere 'truth makers' for their defining conditionals C (e.g. '*a* would dissolve if put in water'). In other words, perhaps the property S that makes C true need only entail more conditionals C' – which need be no more essential to S than C is. So S may simply be identified by a true theory which entails C' & C: just as Newtonian mass (M) is identified by Newton's laws of motion. This may be all the identification that dispositionally defined properties need.

Much recent work on mental and other dispositions, and further references, may be found in the following collections.

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D. H. MELLOR

Disputatio, Post-Medieval

The post-medieval *disputatio* (disputation from around the early 16th to the late 18th century) remains a little known topic in the history of logic with only a handful of secondary sources devoted to it (see Angelelli 1970, Ashworth 1988, and Felipe 1990). The most common technique of disputation from this period (studies of this technique have focused primarily on German second scholastic sources) has been called the 'argument' or 'syllogistic' technique in which a Respondent defends a thesis against arguments advanced by an Opponent. The sources mention

several aims for the technique, but there seems to be agreement that the primary aim is the investigation of truth. Rules determining when a disputation is won or lost are never explicitly stated, so the account of how this primary aim of disputation is to be achieved must be abstracted from the sources.

Rules of proof and a wide range of presuppositions to the disputation provide the guidelines to determine which party is to prove and how a proof is to be evaluated. The rules of proof commonly accepted are *affirmanti incumbit probatio* and *quod opponens teneatur ad probationem*. These rules are usually interpreted to mean that the Opponent is almost always held to prove his claims; whereas the Respondent is not held to prove his 'affirmations' nor is he obligated to prove the thesis (an exception to this is that if the Respondent denies the formal implication of the Opponent's argument, the Respondent must prove it invalid). The presuppositions of the *disputatio* fit neatly into the *material/forma* distinction. The formal presuppositions are logical rules determining the validity of categorical and hypothetical syllogisms which can be used by the Opponent to justify the formal consequence of an argument if its form is attacked by the Respondent. The material presuppositions are far-reaching claims about what is known to be true, plausible, doubtful, or false.

The possible topics of dispute extend to any subject about which there exists doubt: ethics, politics, religion, or metaphysics. Consequently, it is difficult, if not impossible, to state the material presuppositions to any given disputation in a systematic way. Kant assailed the *disputatio* because of its unjustified metaphysical assumptions concerning matters beyond the realm of possible experience (*Logic* A11, *CPR* A60–2). This is strictly speaking, however, not a criticism of the methodology of disputation nor of the assumptions needed to dispute subjects besides metaphysics. Nevertheless, Kant considered some metaphysical assumptions of post-medieval disputation essential to disputation itself.

The Kantian view that metaphysics is in some ways essential to disputation contrasts with the lack of any treatment of metaphysical assumptions in almost all the second scholastic tracts and treatises on disputation. The rule adopted to prevent endless trains of disputation is *contra negantem principia non est disputandum* which determines that any proposition known to be true cannot be disputed or denied; but this rule is never explained by examples; for instance, Clemens Timpler in his *Logicae systema methodicum* (1612), warns that principles of metaphysics should not be disputed, but he gives no examples.

A full treatment of the metaphysical presuppositions of post-medieval disputation, one which takes into account the differing metaphysical views at various academies and schools, could only be given after extensive reading of the hundreds of disputations and dissertations devoted to metaphysical topics. This article cannot even scratch the surface of such a project, but it should be mentioned that among the second Scholastics some non-Aristotelian theses were disputed, a fact which indicates some flexibility in some sources in applying the rule *contra negantem principia non est disputandum* to metaphysical topics. In Jakob Thomasius, *Erotemata logica* (1677) for instance, "Is man a rational animal?" is used as an example of a question for dispute, and arguments opposing the thesis that man is a rational animal are considered. In addition, the first edition of *Erotemata logica*, which contains a whole section on disputation, is published in the same volume as *Erotemata metaphysica* (1677), but there are no cross-references between the two works. This is a good example of the theoretical independence of disputation and metaphysics, in so far as the former properly belongs to the study of logical methodology.

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DONALD FELIPE

Distinctions

Aristotle. The point of departure for the medieval scholastic doctrines on distinction is passages in Aristotle's works where he spoke of items that are 'one (or the same) in number' yet distinct 'in definition' (alternatively 'in being' or 'in form'). The idea here was that even in cases where we are confronted with a single phenomenon rather than a class of several, as long as there are different non-synonymous descriptions applicable to it, there will be a distinction between individual entities that coincide in that phenomenon. One of Aristotle's examples was the road from Athens to Thebes and the road from Thebes to Athens. These coincide spatially and materially, but simply because going from Athens to Thebes is not the same as going from Thebes to Athens these roads are distinct in definition or being. Maintaining this kind of distinction allowed Aristotle to have a distinct individual subject of predicates for every non-synonymous way of describing a particular thing or phenomenon. Consequently, he could ascribe contrary predicates to the same thing under different descriptions, without claiming that precisely the same item directly bears these contrary attributes and thus violating the law of non-contradiction. There was no suggestion on his part, either, that these entities and their distinctness were mind or language dependent; they were not introduced but merely recognized by the mind when it drew distinctions between concepts.

Aristotle's doctrine was particularly interesting to the scholastics because their theology compelled them to draw distinctions where there were not supposed to be any, namely in God, a completely non-composite or simple being. Despite his simplicity God somehow contains three persons all distinct from each other but each the same as the divine essence. Further, acts of God's intellect are the basis for acts of God's will; does this not imply some distinction between the divine intellect and the divine will? Likewise, in regard to the divine perfections of omnipotence, wisdom, mercy, justice, etc.; can it really be maintained that these are all exactly the same attribute?

Peter Abelard. In the early scholastic period the most subtle discussion of sameness and distinction occurred in Peter Abelard's *Theologia Christiana*, Books III and IV. Abelard sharpened the notion of being distinct in number by reserving it exclusively for entirely separate things which share no common part. Sameness in number is, on the other hand, stronger than mere non-distinctness, and amounts to having all parts in common. This Abelard also called sameness 'in essence'. Distinctness in essence, however, is just non-sameness so that it requires nothing more than that some part of one not be a part of the other, and so distinctness in essence allows overlap and thus is weaker than numerical distinctness. To be the same in essence is just to coincide in precisely the same thing, on Abelard's scheme.

Nevertheless, items can be the same in essence but differ as to properties. Abelard described two ways in which this could happen. The first was where the one item bears some irreflexive and asymmetric relation to the other. Abelard's examples all involved something which is the matter of something else, e.g. wax and a wax statue. We can say the wax is the matter of the wax statue and is prior temporally to the wax statue; but we cannot say the wax statue is the matter of the wax statue nor that the wax statue is prior to the wax statue. Without doubt, though, the wax and the wax statue coincide in all their parts and thus are essentially the same. Abelard said we have here items that are distinct in property but not in essence.

The second way involves cases where because we have properties with different definitions applying to the same essence we speak of items which are not the same as each other in definition even though they are the same in essence. One thing is the same in definition as another if and only if the mere fact of the existence of the one entails the existence of the other, and vice versa, as is the case with a blade and a sword, for example (where 'blade' and 'sword' are taken as synonymous, i.e. the property of being a blade and the property of being a sword are indistinguishable). An example of items that are distinct in definition but the same in

essence occurs when the same string of sounds is both a noun and a verb, or an assertion and a question. We do not say the noun is the verb, or the assertion the question, even though in each case they are the same essence. Since the noun and the verb, or the assertion and the question, are distinguished by the difference between what it is to be a noun and what it is to be a verb, or what it is to be an assertion and what it is to be a question, affirming the sameness of the noun and the verb, or the assertion and the question, will amount to identifying those definitions, rather than the essences, and thus will be clearly false.

13th Century. Although Abelard tried to ground distinction of this latter type in a prior distinctness of properties, there was, as in Aristotle, no attempt to view the distinctions as merely conceptual or mind-dependent. In the later scholastics, on the other hand, this question of mind-dependence vs. mind-independence came to the fore. In St. Bonaventure, for example, besides a 'real' distinction (where it is not possible to identify numerically one extreme with the other) and an 'attributional' distinction based on different 'modes of being' (where a numerical identification is possible but a predicate may hold of one term and not of the other), we find, as well, a 'rational' distinction based on two different 'modes of understanding' the same thing. In this case the principle that what is true of one will be true of the other, and vice versa, seems to hold for all predicates except those which implicitly or explicitly relate their subjects to how they are conceived. Many attributes which we ascribe to God are distinct only in this last way, although the same terms applied to creatures will refer to really distinct attributes. For example, goodness and magnitude in a human being are really distinct, but in God they are only rationally distinct, for in the divine case nothing 'on the part of the thing' (*a parte rei*) corresponds to the distinction. In effect, Bonaventure has demoted Aristotle's and Abelard's distinction in definition to a distinction between subjective entities which may or may not correspond in a particular case to an objective distinction between objective entities. In this way we can recognize distinctions among the many things we say of God without implying any distinctions in God himself.

Later 13th-century thinkers introduced a further sophistication by distinguishing within the realm of rational or mind-dependent distinctions those that have a 'real foundation' (sometimes called the virtual distinction) and those that do not. The former involve concepts which apply to a reality because of that reality itself or something in that reality, although it may be the same real entity which grounds the application of distinct concepts to the same thing. It is the same reality, for example, that grounds the application of the concepts of goodness and power to God even though those concepts are different and consequently God's goodness and power are rationally distinct. On the other hand, logical and grammatical concepts like universal and particular, abstract and concrete, do not apply to items because of any grounding reality in them; rather the ground is in the concepts, i.e. in the ways in which we understand something. In this way it was possible to mark off rational distinctions that properly function in a real science like theology from those that pertain solely to rational, i.e. logical or linguistic, disciplines.

John Duns Scotus. This trend of thought was rejected by John Duns Scotus, perhaps the most original thinker among the scholastics so far as questions of ontology are concerned. Returning to a position more like Aristotle's or Abelard's, Scotus took differences between definitions to reveal objective distinctions, not just conceptual ones. This led him to claim that among distinctions *a parte rei*, i.e. those that exist prior to any intellectual activity, there are some where the distinct entities are separable, at least by divine power, and those where they are not, even though they have independent definitions. For example, it may well be that a human being's intellect and will cannot even in principle be separated, but since what it is to be an intellect and what it is to be a will are separately definable, there is still in humans some distinction of their intellect from their will which exists prior to anyone's forming concepts of intellect and will.

The notion of separability of entities here is somewhat vexed. Scotus did not make clear

whether separation requires only that at least one of the items be capable of existing while the other does not, or that each be capable of existing although the other does not, or that both be capable of simultaneous existence while not being united as they were previously. The idea of separate definitions, however, is fairly clear. When we come to define the general notions of which each entity is respectively a particular instance, we must find that the understanding of neither notion requires the other to be understood. Thinking, i.e. the activity of the intellect, is quite intelligible apart from willing, and vice versa; hence a person's intellect and will are, as Scotus termed it, formally distinct.

Scotus spoke of the formal distinction as a 'qualified' real distinction which is less than the absolutely real distinction that requires separability of the entities. He thus allowed differences of degree among the distinctions that are *a parte rei*. There are, according to him, some that are even less a distinction than the formal, for example, the modal distinction, which exists between a degree and a quality that has that degree. It is easy to see that this line of thought can lead to a host of different sorts of entities that are not absolutely really distinct from the ordinary substances and qualities that every medieval metaphysician countenanced but yet are distinct in some real though lesser sense.

William Ockham. In reaction to Scotus, William Ockham contended that the only distinction that is independent of our conceptualization is the one that requires separability. All other distinctions are 'rational', i.e. mind-dependent in one way or another. Ockham argues that if we do not allow the principle that contradictory predicates cannot be simultaneously true of items that are really the same thing, then there will be no way to argue for any sort of real distinction at all. But Scotus's position certainly has the result that items which are really the same (i.e. inseparable), e.g. will and intellect, are subjects for contradictory predicates, e.g. 'directly brings about action' and 'does not directly bring about action'.

Ockham also clarified the doctrine of rational distinctions. Whereas his predecessors had talked as though the things rationally distinguished were objective, real items while the distinction itself depended on differences in the way those things were conceived, Ockham held that only concepts in the mind are rationally distinct. His point made it clear that the concept-analysing activity of the logician deals solely with mind-dependent entities and cannot automatically be seen as saying anything about mind-independent entities.

This view coupled with his opposition to any sort of 'lesser' real distinction safeguarded Ockham's ontology against the proliferation of entities we saw Scotus's position led to. For Ockham the only distinct entities were those things which God could make exist apart from everything else. The conflict of Scotists and Ockhamists on matters of ontology, which was a prominent feature of late medieval and Renaissance scholasticism, promoted the whole question of distinctions into the front rank of philosophical problems with which any serious thinker had to grapple.

Francisco Suárez. This continued to be the case right up into Renaissance scholasticism. Francisco Suárez devoted one of his *Metaphysical Disputations* to the doctrine of distinctions. He saw that Scotus's characterization of separability needed clarification, and he limited the real distinction to cases where both of the items distinguished can in principle be simultaneously maintained in existence apart from their previous union. He also effectively dropped Scotus's formal distinction to return to something more like the virtual rational distinction of 13th-century thinkers. On the other hand he does maintain a lesser real distinction of his own, which he calls 'modal'. This distinction seems designed to handle cases where one reality is different from but ontologically dependent on the other, as figure is on a body and the inherence of a quantity in a subject is dependent on the quantity.

Suárez and other scholastics were well known to non-scholastic philosophers of the 17th century such as René Descartes, Antoine Arnauld, Leibniz, and Spinoza; the controversy between Arnauld and Descartes on the distinction of soul and body reflects this influence. However, in general the topic of

distinctions tended to be dismissed with impatience the more modern philosophy cut its ties with its scholastic forerunners.

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MARTIN TWEEDALE

Drobisch, Moritz Wilhelm

Moritz Wilhelm Drobisch was born on 16 August 1802 and died on 30 September 1896 having spent his entire life in the town of Leipzig. There Drobisch studied mathematics, astronomy, and natural sciences, becoming professor of mathematics in 1826. Impressed by the mathematical psychology and metaphysics of J. F. Herbart, he embarked on teaching and publishing in this field as well, and received an additional professorship in philosophy in 1842.

Drobisch's departure from mathematics is conspicuous in his treatise on logic, which ran through five editions (*Neue Darstellung der Logik*, Leipzig, 1836). Here, Drobisch advocates formal logic performed in a mathematical fashion against the then prevailing claims of transcendental logic. He regards logic as a prescriptive and normative system, not as a descriptive concern tracing the operations of thinking. This rejection of what would later be called 'psychologism' in logic makes Drobisch a predecessor of Gottlob Frege and Edmund Husserl.

Drobisch's reviews in the late 1820s of Herbart's writings on psychology were crucial in creating an audience for the concept of a mathematical psychology. Drobisch adopted the division between an empirical and a rational or mathematical psychology, held up by Herbart against Kant. He stressed, however, that one would have to start with an empirical psychology cleared from all speculative presuppositions before one could proceed to a clarification of the metaphysical groundwork and the construction of a mathematical psychology (*Empirische Psychologie nach naturwissenschaftlicher Methode*, Leipzig, 1842; *Erste Grundlehren der mathematischen Psychologie*, Leipzig, 1850).

Drobisch himself remarked correctly that the label 'Herbartian' turned into an impediment for the recognition of his own contributions to philosophy as original achievements.

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HORST GUNDLACH

Duhem, Pierre. See: Holism

Dummett, Michael

Michael Dummett, English philosopher, born 1925, has been Wykeham professor of logic at Oxford from 1979. Although most of Dummett's philosophical work may be classified as belonging to logic, philosophy of mathematics, or philosophy of language, metaphysical concerns are present in much of his writings and constitute even the focal point of many publications. The opposition between realism and idealism or, to use Dummett's more colourless term, *anti-realism*, has then been the dominant issue. Dummett has approached this issue in new terms, and has initiated a lively discussion that has now gone on for many years.

More precisely, Dummett claims that questions in the theory of meaning underlie the idealism–realism issue. A realist position as characterized by Dummett involves not only the belief that reality is *external* to us, i.e. consists of objects that are given independently of us and our capacities, but also and more importantly, the conviction that reality is fully *determinate*, which is to say that each statement about reality is determinately true or false even if it is beyond our capacities ever to discover whether it is true or false. On this view, a realist interpretation of a range of statements requires that we can confer on those statements meanings such as to yield a notion of truth for which the *principle of bivalence* – the principle that every statement is true or false – holds.

In the preface to *Truth and Other Enigmas*, in which many of Dummett's papers are collected, Dummett says that if he has made any worthwhile contribution to philosophy, it must lie in having raised metaphysical issues in these new terms. Besides raising old questions about realism in new terms, Dummett has set forth powerful but controversial arguments against the realist position, or rather against realist views towards certain subject matters. Although the disputes between realist and anti-realist views of different subject matters are seen by Dummett to have some similar features, the arguments that are used in these various disputes must vary in details – one can very well be a realist about one subject matter and not about another. There is, according to Dummett, no coherent position which consists in being a realist *tout court*. A realist position must therefore concern some specific subject matter, and it is best understood as a view about a realm of statements. Dummett discusses realism for several different categories or statements, among which are mathematical statements, statements in the past tense or in the future tense, and statements about mental states. His discussion typically takes the form of a dialogue where conceivable arguments for and against a realist position are investigated, without there being a definitive conclusion that settles the dispute.

The main argument that Dummett considers against realism is directed against what may be called recognition-transcendent truth conditions. By insisting that statements are determinately true or false independently of whether we are in principle able to know their truth value, the realist is in fact insisting, Dummett argues, that in some cases knowledge of truth conditions of sentences may contain elements which cannot be manifested in the use of these sentences. But this leads, according to Dummett, to the unacceptable consequence that the meanings of these sentences, which are supposed to be given by their truth conditions, contain elements which play no role in the use of these sentences and are therefore inessential to communication. To believe, as the realist does, that a sentence can be understood in terms of recognition-transcendent truth conditions that determinately obtain or do not obtain, seems therefore to be an illusion – or so Dummett concludes.

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DAG PRAWITZ

Duns Scotus. See: John Duns Scotus

E

Ego

Linguistically, the expression 'the ego' ('*das Ich*', '*le Moi*') is the substantivization of the personal pronoun 'ego' = 'I'. This pronoun belongs to the wide class of so-called indexical expressions, comprising e.g. 'you', 'it', 'here', 'today'. As with all indexical expressions, the reference of 'ego' can be determined only from the context of utterance

(occurrence): if John says '*ego cogito*', then 'ego' denotes John.

The question of what kind of entities can be denoted by 'ego' has a simple and straightforward answer: everything that can utter a *true* sentence containing 'ego' functions *eo ipso* as a denotatum of 'ego'. If a machine utters the true sentence '*Ego cogito*', then 'ego' denotes the machine. The question is, however, whether the sentence '*Ego cogito*' can be true, if it is uttered by a machine.

But what is denoted by the substantivization 'the ego'? The logical status of 'the ego' is not that of an indexical expression, but rather that of a definite description. Thus it must have exactly one denotatum if it is to be a legitimate expression at all. In the history of philosophy proposals have been advanced for a unique denotation for the definite description 'the ego', e.g. the world soul of Neoplatonism, the 'subject' of the German Idealists and the 'transcendental ego' of Edmund Husserl. The ego, or better the Ego, in each of these senses is opposed to the world, either as the creator of the world or as a kind of epistemic source of world cognition or world constitution. Thus Johann Gottlieb Fichte's *Ich* constitutes all there is: both *Ich* and the non-*Ich*, the self-reference of the ego being understood as a kind of causal or quasi-causal relation.

The *unique denotatum* of 'the ego' seems inevitably to be a metaphysical entity, whose formal ontological status is in bad need of clarification. Normally, therefore, there is envisioned a plurality of egos. For, besides the substantivization 'the ego' there are also substantivizations like 'my ego', 'your ego', 'his ego', and 'the ego of N. N.' The expression 'my ego' is a composition of a possessive pronoun with a personal pronoun, and is an indexical expression, like 'my' itself. On the other hand, 'the ego of N. N.' is not indexical, but a definite description. If M. M. is different from N. N., then this implies that 'the ego of N. N.' and 'the ego of M. M.' have different denotata.

Consider, now, the situation where 'my ego' and 'ego' are used by the same person N. N. in true sentences. As before, 'ego' denotes N. N. But what does 'my ego' denote? Of course, it denotes the ego of N. N. However, since N. N. has properties, e.g. that of being black-haired, which the ego of N. N. does not have, N. N. must be different from the ego of N. N. Logico-linguistic considerations thus seem to lead to the recognition of a realm of new entities existing alongside the persons 'having' them. On the ontological level, there arise two main questions:

1. What kinds of entities are egos?
2. What kinds of entities can have egos?

These two questions are not independent. For if there are several classes of entities, say K_1, K_2, K_3, such that each element of each such class has an ego, then the egos of class K_1 may be ontologically different from the egos of class K_2, and from those of class K_3.

So let us begin with the class of persons. It is commonly held that each person has an ego and in the normal case not more than one ego. The first ontological question about personal egos is whether they are in the (empirical) world, or outside it. If egos are outside the world, then their proper ontology is the ontology which is concerned with extramundane entities. According to some theological opinions, egos can be outside the world, e.g. the ego of the personal God and the egos of angels. It is also sometimes believed that the egos of human persons are outside the world after the death of their bodies. The extramundane ontology of such beings is a difficult subject, and already Augustine in his *Confessions* complains that the Aristotelian categories are inapplicable within extramundane ontology. So let us consider egos in the world. Take, for example, the traditional bipartition of all intramundane entities into substances and accidents. On the basis of this system, an ego must be either a substance or an accident.

Case 1: **An ego is an accident.** Then we must look for a substance in which the ego as accident inheres. There seem to be essentially three possibilities:

1. the ego inheres in the body of the person;
2. the ego inheres in the mind (or soul) of the person;
3. the ego inheres in the whole person, as composed of mind and body.

From this conception of the ego there follows by the law of *non migratio accidentium* that two bodies (minds, whole persons) cannot share the same ego. This may be considered as an advantage of this view. But the conception of egos as accidents also has some disadvantages. The first is that all concrete properties inhering in an ego and all processes which it undergoes must be accidents of accidents, and it is questionable whether such 'second order accidents' exist. Another disadvantage follows from the very law of *non migratio accidentium*: if the subject of inherence becomes different, then all its accidents must be different, too. This implies that if my body (or mind) becomes different, then I have an ego different from the one I had before. Empirical psychology seems to treat egos as accidents of bodies or whole persons, an opinion that is also sometimes popularly expressed as 'egos are functions of the body'. A final consequence is the following: since an accident cannot exist without the substance in which it inheres, egos will wither away with the death of the body (the mind, the whole person).

Case 2: **An ego is a substance.** First, we may ask for the evidence in favour of such a view. Kant has made the important remark that the fact that the ego functions as a *subject of predication* does not imply that it is also a *subject of inherence*, i.e. a fully fledged substance. 'The ego is thinking' may also be interpreted as saying that thinking occurs ('*Es wird gedacht*') and that this occurrence is in a certain space which is delineated by 'I', and not e.g. by 'you' or 'he'. There seems to be no linguistico-logical proof that egos are substances. And it is clear anyway that we must consider the question whether egos are substances in purely ontological terms; for it is an ontological question. If egos are substances, then, by the traditional law governing the notion of substance, they must consist of form and matter. It seems to be clear that the matter of an ego cannot consist of chemical elements, but of some more ethereal stuff, we know not what. Another difficulty is caused by the usually assumed simplicity of the ego. Egos, then, would be simple substances (monads). However, the very notion of a simple substance presents many problems, the foremost being that a simple substance could not be composed of form and matter. The monads of Leibniz are, it must be remembered, only *mereologically* simple, i.e. they have no substantial parts; they are, however, complex in that they have many accidents, i.e. perceptions, appetitions, etc. The mereological simplicity of the ego or the soul goes back to Plato and is used by him for his immortality proof.

As a substance in the world, an ego cannot be both temporally and spatially simple; it must be at least temporally extended, since it could not otherwise undergo temporally extended processes and states. Thoughts as acts (as accidents) of the ego are temporally extended, although they may not be spatially extended. Thoughts as acts are temporally located, though perhaps not spatially. We are still discussing egos of persons and are still assuming that they are in the world. We have pondered the two possibilities: that egos are accidents and that they are substances.

The discussion thus far shows clearly that the discussion of the ontological status of egos presupposes some precise ontology. The ontology of substances and accidents seems to be too narrow for many legitimate purposes, especially for the determination of the ontological status of egos. Indeed, there seem to be, besides substances and accidents, further entities in the world, of a more formal character. Examples may be: the inherence relation, boundaries, directions, centres of gravity, foci of mirrors, etc. This opens up the possibility that an ego is a kind of focus in which the intentional radii of mental acts converge. I think that the true essence of egos is indeed to be accounted for along these lines. However, ontology in its present state seems not to be able to transform the more or less pictorial statement 'egos are foci' into a scientific sentence.

Besides the alternatives of being totally in the world and totally outside the world there is, however, a third possibility. As Ludwig Wittgenstein writes in *Tractatus* 5.632, "*Das Subjekt gehört nicht zur Welt, sondern ist eine Grenze der Welt*" and asks in 5.633, "*Wo in der Welt ist ein metaphysisches Subjekt zu merken?*". The context of these remarks suggests that Wittgenstein does *not* mean to

refer to any of the above-mentioned unique denotata of the definite description 'the ego', but rather to the denotata of expressions like 'my ego', 'the ego of N. N.' – though this matter is, admittedly, not quite clear. One should compare 5.63, "*Ich bin meine Welt*" and 5.641, "*Das Ich tritt in die Philosophie dadurch ein, dass die Welt meine Welt ist*". *Summa summarum*, Wittgenstein seems to mean, that his ego, like every other ego, is the boundary of his world, not part of his world. The problem with this conception is that it is not quite clear whether it is an epistemological or an ontological doctrine. In favour of its epistemological character we may cite 5.6, "*Die Grenzen meiner Sprache bedeuten die Grenzen meiner Welt*". From this it would seem to follow that Wittgenstein's ego is the boundary of his *language*, or part of this boundary.

The Self-Referentiality of the Ego. It is commonly believed that it is a distinguishing feature of an ego that it can refer to itself. Clearly, a person can refer to himself, e.g. by saying 'I'm tired'. A main traditional source of self-referentiality is the existence of higher acts like thinking and knowing: if I think, then *eo ipso* I think that I think. We have, however, already seen, that the reference of 'I' in such sentences is not an ego, but the person uttering the sentence. The question of the self-referentiality of an ego is not the question whether a person can refer to himself; indeed these two questions are often confused. Thus whereas it is undoubtedly true that persons can refer to themselves, it is controversial whether personal egos can do so. Arthur Schopenhauer (1788–1860), for example, holds that the subject (the ego) is only perceiving ('*erkennend*'), never perceived ('*erkannt*'). Thus according to Schopenhauer there is no self-referentiality of an ego. The matter of the self-referentiality of (personal) egos is, in my opinion, still unsettled, and we can only formulate a conjecture to the effect that every personal ego (ego of a person) can refer to itself (*Conjecture I*).

Let us now consider the following (partial) converse of this conjecture (*Conjecture II*):

> Whatever can refer to itself, is an ego or has an ego.

This conjures up a cluster of very modern themes, e.g.

1. self-referential sentences,
2. self-referential theories,
3. self-referential programs (machines).

Ad 1. Still the best example is the paradox of Epimenides (*c.* 6th century BC), encapsulated in the sentence:

> I, this sentence, am false.

In this formation, the sentence openly has an ego. If we reformulate it as:

> This sentence is false,

then it does not openly have an ego. But since it refers to itself, *Conjecture II* yields the thesis that it has (or is) an ego. Now, the ego of a sentence does not seem to be in the (empirical) world. Rather it seems to belong to the same realm to which the senses or meanings of sentences belong.

Ad 2. Kurt Gödel constructed a sentence of formal arithmetic which says 'I am unprovable'. More exactly, Gödel did the following. Let *PA* be formalized Peano Arithmetic, and Prov( ) the standard provability predicate of *PA*. Then there is a sentence φ such that:

$$PA \vdash \varphi \leftrightarrow \neg \mathrm{Prov}(\ulcorner \varphi \urcorner),$$

where $\ulcorner \varphi \urcorner$ is the Gödel number of φ. Then φ says of itself via its Gödel number that it is unprovable. The construction of φ is only a special case of a general 'fixed point theorem' or 'self-reference theorem', which can be proved for every formal system containing arithmetic. *PA* is able to produce such a self-referential statement, but unable to decide it. What is the reason for the self-referentiality of such formal systems? It is the possibility of 'arithmetization', that is the possibility of translating syntactical descriptions into formulas of the system itself. It is not clear whether the human mind has analogues of such internal coding facilities. Here we may add that the old saying of Socrates: 'I know that I know nothing' is also undecidable in *PA*, if we translate it as Prov

$(\forall x \neg \mathrm{Prov}(x))$. *Conjecture II* once more yields the thesis that every formal system containing arithmetic has an ego (or is an ego).

Ad 3. By a fixed point construction akin to Gödel's fixed-point theorem we can construct Turing machines (Turing programs) which always yield themselves as outputs. By *Conjecture II*, every such machine has an ego.

The egos of sentences, theories, and machines seem to belong to a hyperworld of entities, together with all mathematical entities. If there are such egos, then these would have to be extramundane egos perhaps in contradistinction to the personal egos considered above.

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J. WOLFGANG DEGEN

Ehrenfels, Christian von

Christian von Ehrenfels was born in Rodaun (near Vienna) in 1859 and died in Lichtenau, Lower Austria, in 1932. He was a noted Austrian philosopher and writer who made contributions to almost every branch of philosophy. After completing his studies in Vienna and Graz with Franz Brentano and Alexius Meinong as his teachers, Ehrenfels first became *Privatdozent* in Vienna, then in 1896 extraordinary professor and in 1900 ordinary professor of philosophy at the German University in Prague, where he retired in 1929. Ehrenfels's work may be divided into four genera:

1. philosophical works, mostly written before 1900;
2. more than fifty essays on eugenics and related subjects in which he derives proposals for reforms in sexual ethics both from a Darwinistic standpoint and from his own philosophy of values – most of these were written between 1902 and 1912;
3. a number of plays and choral dramas, in many of which he demonstrates his reformatory ideas;
4. writings on the life and work of Richard Wagner.

His philosophical work deals with three main topics: psychology, values, and metaphysics. The first consists mainly of his habilitation thesis, *Über Fühlen und Wollen: Eine psychologische Studie* (1887) and his famous essay of 1890 "Über 'Gestaltqualitäten' ", the starting-point of Gestalt theory.

According to Ehrenfels, *Gestalt qualities* are characterized by two criteria:

1. *Übersummativität* (the whole is more than the sum of its parts). Compared with a mere sum, a Gestalt is defined by a certain order, relation, or configuration of its elements.
2. *Transponierbarkeit* (transposability). Ehrenfels borrowed this latter notion from music, which provided him with the original model for his conception of Gestalt structure. A melody may be played in different keys, i.e. it may be *transposed* by changing each note but retaining the relations between the notes. The melody then remains the same, i.e. it has the same Gestalt quality as before.

With his pioneering work, Ehrenfels revolutionized 19th-century psychology, which was mainly a psychology of elements and associations. The concept of Gestalt, systematically developed by Max Wertheimer (1880–1943), Wolfgang Köhler (1887–1967), and Kurt Koffka (1886–1941), led to important philosophical discussions and exerted a great influence on various disciplines.

As for the philosophy of values, Ehrenfels's major contribution was his *System der Werttheorie* (1897–8). Like other disciples of Franz Brentano, Ehrenfels intended to develop a common basis for all kinds of values (ethical, aesthetical, and social values as well as those of economics) with the use of principles taken from the economist Carl Menger (1840–1921), above all from Menger's theory of marginal utility, and from Brentanian psychology. According to Ehrenfels, values are to be described as mere functions of desires. The historical background to and the reasons for this change towards a theory of values based on economical principles (which themselves were formerly assessed on the basis of ethics) are worth thorough examination.

As to metaphysics, Ehrenfels set out his standpoint in two treatises: in his essay *Metaphysische Ausführungen im Anschlusse an Emil du Bois-Reymond* (1886) and in his *Kosmogonie* (1916). The former is concerned with the philosophical riddles of materialism set out by Emil du Bois-Reymond (1818–96) in his famous lecture *Die sieben Welträtsel*. Ehrenfels answers from a spiritualistic viewpoint by ascribing reality only to what is psychical and denying it to the so-called material and spatial world. He develops this view in detail in his *Kosmogonie* and sets out an extensive dualistic cosmogony based on two world principles which he calls God and Chaos. This dualism provides the philosophical foundation of a new religion, which Ehrenfels put forward in his *Die Religion der Zukunft* (1929).

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Eleatics

'The Eleatics' is the name given to a group of three Greek philosophers of the 5th century BC who advanced arguments denying the reality of motion and change, and hence denying the reality of the world as we perceive it. The name derives from the Greek town of Elea in southern Italy, the home of Parmenides (born *c.* 515 BC), who was the first and most important of the Eleatics (he is the subject of a separate article). In the first sustained, self-consciously rigorous *a priori* argument in Western philosophy, Parmenides began from the premiss that "what is not cannot be grasped or spoken of" (Diels and Kranz 1960, Fragment B2), and attempted to conclude that the only reality is a single, perfect and unchanging individual, lacking spatial or temporal differentiation and accessible only to thought; the ideas of plurality, motion, change, generation, and destruction are illusory.

Like Parmenides, Melissus of Samos (dates unknown: probably born *c.* 490/80 BC) offered a purportedly rigorous *a priori* deduction to show that what exists is one single, eternal, and unchanging thing. His system differed from that of Parmenides in a number of important respects. Parmenides had attributed spatial extension to his one real entity, but no temporal duration, apparently taking the whole of time as comprising a single durationless instant. Melissus insists on a strict parallelism between space and time, and gives his entity temporal as well as spatial extension. Parmenides had identified the perfection of what exists with symmetry and the possession of limits: "it is complete on all sides like the bulk of a well-rounded sphere, equally balanced from the centre in all directions". Melissus, by contrast, produced arguments to show that what exists must have an infinite spatial extension with no centre and no limits.

Melissus is generally regarded as a markedly inferior thinker to Parmenides. This view (which derives from Aristotle's severe judgement in *Phys.* 1.2–3) has recently been challenged by G. Reale and J. Barnes, who argue that Melissus was bold and innovative. The truth probably lies in a com-

bination of both views: Melissus certainly appears to have been guilty of the elementary fallacies which Aristotle points out; but he also produced some powerful and influential arguments, such as his argument for the existence of only one real thing (Fragment B6), and also his argument against the possibility of motion (B7): motion would require an empty space for the mover to move into, and (by another influential argument), genuinely empty space, or void, is nothing and so cannot exist – so there can be no motion.

Zeno of Elea (born *c.* 490 BC; not to be confused with the 4th-century Stoic philosopher, Zeno of Citium) did not develop a metaphysical system; instead he produced a number of polemical arguments:

> to defend the arguments of Parmenides against those who try to make fun of him . . . by showing that their hypothesis of the existence of a plurality is still more ridiculous than the hypothesis of the existence of the one (Plato, *Parmenides*, 128c–d).

He wrote a treatise containing forty arguments, each designed to show that if there is a plurality of things, they possess contradictory properties: they are both at rest and in motion, both limited and unlimited in number, both infinitely large and having no size at all, and so forth. Zeno also constructed four famous paradoxes of motion which are reported by Aristotle (*Phys.* VI.2 and 9). Of these the most famous is the argument – sometimes called 'Achilles and the tortoise' – which appears to show that a fast runner can never overtake a slow one who starts even a little way ahead of him. Suppose that Achilles starts from *A* and the tortoise from *B*. In order to overtake the tortoise, Achilles must first run from *A* to *B*; but by the time he reaches *B* the tortoise has moved on a little way, to *C*; so now Achilles must run to *C*; but by the time he has done that, the tortoise has gone a further distance, to *D*. This process goes on *ad infinitum*, so that no matter how many stages of it Achilles goes through, the tortoise remains a small distance ahead. The 'Stadium' paradox is similar: to traverse any distance at all, one has first to traverse half the total distance, then half of the remainder, then half of the new remainder, and so on *ad infinitum*: no matter how many of these distances are traversed, there is always a further one remaining. Both of these paradoxes rely on the idea that an *infinite* series of tasks cannot be completed. The 'Arrow' paradox and some of the arguments against plurality mentioned above also exploit in various ways the ideas of infinity and infinite divisibility. Thus, for example, Zeno argues (fallaciously) that the members of a plurality must be infinitely large because they must have an infinite number of parts.

Zeno was not a constructive metaphysician: his arguments all have the negative, though ambitious, aim of demonstrating the incoherence of the ideas of plurality and motion. These arguments vary greatly in quality. Some are trite, or, like the argument for infinite size outlined above, rely on fallacies that (now, at any rate) seem obvious; but others, such as the 'Achilles', 'Stadium', and 'Arrow' paradoxes, are undeniably profound.

The Eleatics were severely criticized by Aristotle, who thought it absurd to maintain a metaphysics which was so obviously at odds with our experience. In *Physics* I. 2–3 and 7–9 he diagnoses their basic error as a failure to see that there is more than one ontological category: the Eleatics falsely treat all sentences of the form '*X* exists' as having to be made true by the same type of thing. In Aristotle's view, an account of how *change* is possible requires the recognition of different ways in which things can be said to be and not to be – potentially and actually, and as matter and as form. In *Physics* VI.2 and 9 and VIII.8 he attempts to refute Zeno's paradoxes of motion. In reply to the 'Achilles' and the 'Stadium', Aristotle agrees with Zeno that an infinite number of tasks cannot be completed, but claims that in traversing a given distance we do not *actually* perform an infinite number of tasks, as the divisions of the distance into an infinite number of subdistances exist only *potentially*.

The influence of the Eleatics on later philosophy was enormous. The arguments of Melissus and Zeno had a formative influence on subsequent Greek cosmology, and especially on Greek atomism; Zeno's paradoxes have inspired two millenia of work on the infinite. Plato owes an incalculable debt to Parmenides, for Parmenides's revolutionary

conception of reality as something perfect, eternal, changeless, and accessible only to thought, was the immediate ancestor of Plato's theory of Forms (it was also, despite Aristotle's antipathy towards Eleatic doctrines, the ancestor of his Unmoved Mover).

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Element

In the 5th century BC, the word 'element' (στοιχεῖον), primarily as a result of its usage by Greek mathematicians, became current in the sense of 'presupposition' or 'logical arrangement of concepts'. This led in the following centuries to its application as a technical term in various disciplines. Thus the linguist understood by elements the smallest parts of speech, the logician our most general notions or the constituents of a proof, while the mathematician came to understand by elements statements bearing to those which follow the relation of a principle as well as the components of a complex figure.

According to Aristotle, these different meanings of 'element' share the idea of something that is primary and forms part of a larger whole. Generally speaking, he understands by elements components of complex entities that cannot be divided further into parts of another kind (*Met.* 1014a25–30). As internal explanatory factors he distinguishes them from principles (ἀρχαί), that is, external causes (*Met.* 1070b22). In his logical writings Aristotle uses the term 'elements' in the sense of principles of proof as well as topics, that is, the readily believable starting-points of a discussion (*Met.* 1014a35 and *Top.* 120b13). As a physicist he understands by elements chemically simple materials, to wit, earth, water, air, and fire, that function as the constituents of complex, material bodies (*De Gen. et Cor.* II,3). Apart from these he admits a fifth element, ether, as the immutable material of celestial bodies.

Each of the first four elements is characterized by two of the most elementary, contrary properties. Thus earth is dry and cold, water cold and wet, air wet and hot, and fire hot and dry. Thanks to these qualitative affinities they are transmutable. Accordingly elements can function as the ingredients of a mixture. By a mixture Aristotle understands the unification of reacting, changed materials. This process results in a new substance characterized by qualities different from those of its elementary components. Yet, though suffering an internal change, these components apparently have the capacity, actualized by external influences, to form such a new substance. Thus, in Aristotle's words, though elements do not actually endure in a mixture, they do last potentially, that is, as far as that capacity is concerned (*De Gen. et Cor.* I,10).

This theory turned out to be capable of more than one interpretation and was widely discussed in the Middle Ages. Thomas Aquinas set the tone with his view that elements lose their forms in compounds but retain their essential properties (*Sum. Theol.* I, qu. 76, a.4 ad 4). Yet, this theory did not explain how the mixing of elements could result in a homogeneous compound. As long as one kept thinking about elements in terms of properties and qualitative change, that question could not be answered.

In the course of the 16th century, Aristotle's doctrine of the elements ran up against a growing opposition, especially from the alchemists, that ultimately led to less orthodox speculations on the nature of elements. Thus Paracelsus (1473–1541) opposed to the Aristotelian elements the three principles salt, mercury, and sulphur, representing the

fixed, fluid, and volatile constituents of all bodies and kept together by the *archeus*, a vital principle. These he understood as immutable substances that continue to exist in compounds. Changes would not flow from qualitative alterations of the elements but from modifications of their spatial composition. Robert Boyle (1626–91), however, considered Paracelsus's principles as well as Aristotle's raw materials rather as compounds than as real elements. In his view, an element not only has to be the absolutely simple product of analysis but the same simple material, for example, sulphur, obtained from different compounds, must also present the same characteristics. Yet despite this emphasis on the empirical properties of elements, Boyle considered the products of analysis as absolutely elementary. Thus, like his precursors, he too mixed up an empirical notion of elements with the idea of elements as metaphysical constituents.

Only Antoine-Laurent Lavoisier (1743–94) defined elements as substances that we actually have not been able to analyse. Thus he not only relativized the traditional notion of element but also gave it a firm empirical foundation. Elements were no longer conceived as imperceptible, absolutely homogeneous substances but as perceptible materials considered as unanalysable only until experience would show otherwise. John Dalton (1766–1844) identified these relative elements with atoms understood as particles that differ only in size and weight and developed a method to determine atomic weights.

In the 1860s, J. Lothar Meyer (1830–95) and D. I. Mendeleyeff (1834–1907) independently discovered that the elements arranged in order of increasing atomic weight showed a certain periodicity and set up a periodic system of elements. This discovery pointed to a strong relationship between the elements and suggested that they are not simple but composed from common constituents. These were still conceived along the lines of primordial, immutable pieces of matter. The 20th-century atomic theory breaks with this remnant of the past. Atoms are composed of protons and neutrons forming a nucleus encircled by one or more electrons. These components are not of a fixed nature but can lose their individuality on merging with larger structures. Accordingly elements are no longer conceived as absolute, immutable building blocks but as relative, transmutable particles.

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JAN PRINS

Emergence

The doctrine that there are 'emergent properties' is sometimes expressed by saying that 'the whole is more than the sum of its parts'. It aims to deny a reductionist claim – that the whole can be reduced to (or is nothing but) the sum of its parts. Both formulations are intolerably vague. What properties of the parts is one to consider? What does 'sum' mean? And what does 'reduction' involve?

The emergentist thesis and its reductionist antithesis can be formulated at many levels of organization. In the social sciences, methodological holism and methodological individualism disagree as to whether social facts can be reduced to facts about individual people. In biology, the dispute might take the form of asking whether a property of an organism reduces to the properties of its parts (e.g., its genes). And as a general problem about the unity of science, one might ask whether the properties of all objects above the level of elementary particles are reducible to the properties of such basic physical entities.

Two extreme theses may be identified and set to one side. The first asserts that the whole and its properties may be reduced to the parts and their *non-relational* properties. This thesis, which might be called *radical atomism*,

is usually not very plausible. A nation's economy cannot be understood in terms of the non-relational properties of the individuals in it. The same holds for an organism and its constituent cells. The whole has the properties it does only in virtue of its parts being related to each other as they are.

The second extreme position may be called *radical holism*. It maintains that the properties of a whole are not fixed by the non-relational and relational properties of its parts. Cartesian dualism in the philosophy of mind and vitalism in the philosophy of biology (as in the work of Henri Bergson and Hans Driesch) may be viewed as examples. Both hold that two objects may have exactly the same physical constituents, and have those parts stand in precisely the same relations to each other, and yet the two objects may differ psychologically or biologically. The first may be in possession of a Cartesian ego or be infused with an *élan vital*, while the second is not. The progress of science tells against radical holisms of this sort.

To reject radical holism is to embrace a thesis of *supervenience*. Two wholes cannot differ unless the parts of one differ from the parts of the other, where this difference may involve relational (organizational) properties as well as non-relational ones.

With the rejection of these radical theses, there remains a detailed question to investigate, one whose answer may vary from problem to problem. What level of complexity is required of the parts and their interactions, if the whole that they comprise is to have a given property? It is a rather simple matter for the organisms in a population to have a given average weight. No complex interaction is needed here. Matters change when we ask how the cells in an organism must be related for the organism to metabolize, respirate, or perceive. Here we see that the word 'sum' – when it is asserted or denied that the whole is the sum of its parts – may require different interpretations in different problems.

Those who have emphasized the great complexity of the interactions among parts needed to secure the property of the whole are often called 'emergentists'. Thinkers like G. H. Lewes (1817–78), C. Lloyd Morgan (1852–1936), and Samuel Alexander (1859–1938) claimed that the properties of the whole are 'unpredictable' from knowledge of the parts. Once 'prediction' is clarified and the properties of the parts (relational or non-relational?) are circumscribed, there is room for an emergentism that does not lapse into radical holism.

Conversely, those who have granted the complexity of interactions, but who have emphasized that this poses no impediment in principle to microexplanation, are often called 'anti-emergentists' (or 'reductionists'). Here we find such thinkers as John Stuart Mill (1806–73), Karl Popper, and J. J. C. Smart.

Emergentism and its denial, though formulated as ontological theses, are often thought to have methodological import. If enormously complex interactions among parts are required for a whole to have a given property, then it may perhaps not be a useful research strategy to try to understand the holistic property by reductionist methods. This is perhaps why no one proposes to investigate the properties of interest in the human sciences in terms of the physics of elementary particles.

Once radical atomism and radical holism are discarded, emergentism remains a vague thesis, the vagueness being due to the term 'complexity'. This does not mean that the dispute between emergentism and its denial cannot be made precise in particular scientific contexts. It is in those specific contexts, not at the level of general metaphysics, that the controversy is a real one, impinging both on strategies of investigation and on the interpretation of scientific results.

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ELLIOTT SOBER

Emotion, Affect

A first ontological definition of 'affect' or 'emotion' is yielded by the history of these words. The term πάθος, used by Aristotle (*De An.* I, 1; *Rhet.* II) is rendered in Latin by *affectio, affectus*, and *passio* (Augustine, *De Civ. Dei* IX, 4). The term 'emotion' goes back to the fact that the πάθη according to Aristotle are processes (κινήσεις; *De An.* 403a26), in Latin *motiones*. Emotions, therefore, fall under the category of passions. They are movements of the power of desiring, which the human being experiences prior to making a decision.

Definitions. Emotions must be ordered within the broader class that also includes feelings and sensations. Four sub-classes can be distinguished on the basis of linguistic criteria:

1. Perceptions, which are characterized by the fact that we can construe the 'feeling' in question either as taking a direct object or as taking a that-clause, without introducing a difference of meaning.
2. Sensations in the narrower sense, e.g. pains, which differ from perceptions in having no object. Instead of 'I feel pain' we can say 'I am in pain'. With 'feeling' in the sense of 'perception' (e.g. of the hardness or the temperature of an object) this substitution is not possible. Pain is not the object of sensation but the sensation itself.
3. Feelings in the narrower sense, which are expressed through the reflexive-adverbial construction ('I feel . . .'). This construction leaves open the possibility that the speaker is deceived concerning his condition. Someone can feel alone without being so, while it is impossible to feel pains without having them. With feelings in the narrower sense I myself am the object of my feelings: I feel alone. Pain, on the other hand, does not necessarily determine my entire state.
4. In contrast to sensations and feelings in the narrower sense, emotions have an object: I rejoice over something; I am angry with someone. A pain which I feel over something is an emotion. Feelings in the narrower sense have a cause, of which I need not be conscious, but no object.

Structural Elements of Emotions.

1. *Relation to an object.* An emotion rests on one's taking for true a statement of fact and an evaluation statement. For instance, one who fears assumes that a certain event, which he takes as evil, will occur. Emotions relating to persons (e.g. anger or pity, as opposed to joy or hope) dispose one to an attitude towards the person to whom they are directed.

2. *Sensation and feeling components.* Emotions are tied to accompanying bodily phenomena, e.g. the excretion of certain substances or a change in blood pressure. These are sensed and in many cases the corresponding sensations may be localized. Beyond this, emotions contain a feeling-component, which affects one's entire state. Emotions determine not only how we feel, but also how we perceive another human being. They have an influence on our judgement concerning other human beings.

3. *Causes and dispositions.* It may be that the question why one fears something determines more exactly the object of an emotion. (John fears the examination, because the examiner is ill-tempered.) However, another kind of answer is possible, which involves reference to experiences or conditions which dispose one to fear. One who experiences an emotion is necessarily conscious of the object of the emotion (one who feels pity knows for whom he has pity and concerning what he has this pity). Concerning the cause of the emotion, however, he may be unconscious. Emotions presuppose dispositions, which for their part have causes. The distinction between object and cause makes it clear that the fact that emotions imply judgements ought not to lead us to a rationalistic misunderstanding, for our judgements of facts and values can be influenced by our dispositions. Someone who is very sensitive will reckon even a justified criticism of him as a disparagement. Three classes of such causes can be distinguished:

a. physiological causes. Someone tends, e.g. to anger, because his blood-pressure is too high;
b. individual life-history. What emotions a human being feels depends upon his upbringing, his experiences and his habits of life;
c. social relationships. Social position and environment have an influence on one's feeling of self-worth and experience of life; the cultural environment shapes one's capacity to feel.

The Distinction of Kinds of Emotion. The following criteria are required to identify a type of emotion.

1. Certain bodily symptoms and/or a certain external behaviour.
2. The supposed state of affairs, e.g. that *B* has lost his position (*p*).
3. The evaluation of the supposed state of affairs. (*A* evaluates *p* as an evil.)
4. *A* must have a certain attitude and social relationships. (*p* could also trigger gloating.) Whether *p* evokes gloating or pity depends upon whether *A* is of good will towards *B* or whether there obtains between the two a relationship of competition or the like.

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Empiricism

As a philosophical doctrine, empiricism has two general components:

1. all knowledge is based upon or derived from experience and observation (hence, no innate ideas), and
2. axioms, maxims, or general principles are rejected as not useful for knowledge.

Various examples of these two components can be found in the history of philosophy. The first component is more prevalent than the second; identifying empiricist elements in a philosopher's writing is often the same as tracing the use made of experience.

Appeals to experience have been made from Aristotle's time to the present. The principle of 'nothing in the intellect which is not first in the senses' was often cited by 17th-century followers of Aristotle. It is often associated with John Locke's name. The medical term 'empiric' is related to 'empiricism' in its sharing of the stress on experience and observation, rather than on theory or past authority. Sometimes 'empiric' was used in a pejorative sense, medical practice devoid of any theory. Leibniz refers to the 'empirical physicians' who practise 'without any theory' (*Monadology* §28). Leibniz remarks that all of us "are empiricists in three-fourths of our actions", giving the example of our expectation "that there will be day-light tomorrow . . . because it has always happened so up to the present time". He contrasts such empiricist expectations with the reason supplied by astronomers which explains such regularities. David Hume had argued that reason cannot penetrate to the secret springs and principles of nature (see especially his *Enquiry concerning Human Understanding*), and in his *Treatise of Human Nature* he gave an extended analysis showing that experience and observation can never discover causal necessities, only correlations. In showing the impotence of reason to solve standard philosophical questions about cause, identity, or freedom, Hume prepared the way for his programme, in Book II of the *Treatise*, of establishing the science of man (psychology and the social sciences) through experience and observation. His claim for general agreement among mankind of what actions are praiseworthy and blameworthy was based upon a kind of survey technique, thus extending the method of experience and observation into these areas. In that way, he found support for the 18th-century notion of a moral sense as part of human nature.

Locke is an even better example for illustrating the two main components of empiricism. He was suspicious of hypotheses in science and medicine, reflecting the Royal Society's announced programme of examining things themselves, of collecting 'facts' about phenomena, and building natural histories. In medicine, Locke shared the belief of Thomas Sydenham (1624–89) in the need for tracing the etiology of diseases, describing and recording the symptoms and their development. Locke also rejected axioms, maxims, and logical principles as a source for knowledge. That rejection went with a spirited attack against formal logic as a method of discovery. Since Locke was trained as a medical doctor, the repeated appearance in his *Essay concerning Human Understanding* of the phrase, 'experience and observation', probably reflects his medical background and the empiric physicians.

Locke's programme of deriving all ideas from sensation and reflection (the twin fountains of experience) also illustrates the 'empiricist' methodology, but it is important to note the inclusion of reflection as one of the sources, a source often ignored by commentators. E. B. de Condillac (1715–80), whose *Essai sur l'origine des connaissances humaines* (1746) was identified on its title page as a supplement to Locke's *Essay*, also included reflection as a source of knowledge, but it played a minor role and he tended to stress the sensory origin only. Locke was thus linked with 'sensationalism' throughout 18th-century France. The influential French teacher and historian of philosophy, Victor Cousin (1792–1867), placed Locke with the school of 'sensualists', whose members were said to claim that all knowledge and ideas were derived from sensation. The mind – which for Locke included reflection and such mental operations as comparing, abstracting, reasoning, and concluding – was thus reduced on this interpretation to a passive, sensory blank tablet.

Kant's interpretation of experience and the various actions of the mind identified by him combine experience-based and perceiver-originated components. His famous opening remark in the introduction to the first *Critique* could be seen as an echo of Locke's combination of experience and an active mind:

> we have no knowledge antecedent to experience, and with experience all our knowledge begins. But though all our knowledge begins with experience, it does not follow that it all arises out of experience. For it may well be that even our empirical knowledge is made up of what we receive through impressions and of what our own faculty of knowledge ... supplies from itself (pp. 41–2, trans. Kemp Smith).

George Berkeley also is usually classified with the empiricists; many departments of philosophy offer courses on the 'British empiricists', Locke, Berkeley, and Hume, in contrast with the 'Continental rationalists', who are supposed to derive knowledge from the faculty of reason alone, eschewing any information derived from experience and observation. What is seen as empiricism in Berkeley's philosophy is his insistence that all we can know, all we have access to, are the phenomena that we observe and experience. Berkeley's rejection of the philosopher's insensible substance illustrates the empiricist elimination of non-experienceable entities and events. Berkeley paved the way for the later development of operationalism in the philosophy of science (e.g. by P. W. Bridgman), namely the attempt to identify the meanings of scientific words with the operations scientists employed in measuring and testing. Berkeley's work on motion, *De motu*, argued against taking Newton's use of words such as 'space', 'time', and 'motion' as referring to ontological items (absolute space and time), and the words 'force' or 'gravity' as naming natural properties inherent in matter. Karl Popper reads Berkeley as anticipating Ernst Mach and the subsequent logical positivism that emerged around the Vienna Circle.

Hume agreed with Berkeley in the rejection of metaphysical presuppositions such as substance, saying repeatedly in his *Treatise* that "all that is ever present to us are our own perceptions". This claim can lead to a form of idealism, where all that exists is mind and the contents of experience. To make such a bold claim is to be dogmatic; Hume was only saying all we can *discover* is experience-based. Hume's own convictions were that

there is an external world with real causal connections, biological bodies with intact nervous systems, and moral persons. The limitation of knowledge to experience carries with it some form of scepticism, a consequence many in the 18th century feared. Similar dissatisfaction was voiced about 20th-century logical positivism and its rejection of metaphysics.

Logical positivism (sometimes called 'logical empiricism') has been a very influential movement in the 20th century. The Vienna Circle, a group that promulgated this programme, included such figures as Moritz Schlick, Otto Neurath, Herbert Feigl, and Hans Hahn. This movement traced its roots through Mach to the 'British empiricists', especially Hume. Logical positivism has been associated with the verifiability theory of meaning, the claim that the meaning of any statement consists in the experience which makes that statement true (see A. J. Ayer 1940). Their programme also included finding a way to accept the non-experiential (analytic) truths of mathematics, geometry, and logic. In fact, their main programme was to defend empiricism by logical analysis. The groundwork for the recognition of two kinds of propositions (analytic and *a posteriori*) was laid by Hume with his distinction of truths of reason and matters of fact.

Another 20th-century version of empiricism, this time having its origins in the United States, was William James's 'radical empiricism'. In his hands, empiricism becomes an ontology as well as a methodology. He begins with experience, but an experience which is prior to any distinction between self and object, a 'pure' undifferentiated experience out of which distinctions of subject and object emerge. James liked to say "everything is composed of experience", or "experience and reality come to the same thing" (1947). On an individual level, radical empiricism lends itself to genetic psychology, showing how the growth of awareness constitutes reality, and stressing the active role we play in forming our world. We might say that James put a metaphysic back into empiricism, but he did so by postulating what phenomenologists later described as a pre-reflective experience, a concept of experience radically different from those of Locke, Berkeley, or Hume. James's brand of empiricism has also been called 'neutral monism', indicating his rejection of the standard two-substance dualism (mind and matter) which characterized philosophy up to the time of Locke and Hume. Bertrand Russell also attempted to construct a neutral monism in his *Analysis of Mind* (1921).

From a methodology of basing knowledge on experience and observation, to an organized programme showing by logical analysis that "propositions of existential import have an exclusively empirical reference" (J. R. Weinberg, p. 1), to an ontology that turned experience itself into reality, empiricism has been highly influential and has taken many forms. Hardly ever is it found in a 'pure' form, as the only method or principle of a philosopher's analysis. It is best to think of empiricism as a principle employed in varying degrees, often combining or even clashing with other deeply held beliefs and presuppositions. It is dangerous to allow the use of the term 'empiricist', when applied to particular philosophers, to serve as an interpretation of all that they said or claimed. It is very difficult to find anyone who has been an empiricist in all aspects of his doctrines. No one of the so-called British empiricists used that term against themselves or others. With all three philosophers, there are many important doctrines integral to their philosophy which do not fit the label. Once labelled 'empiricist', the tendency has been to use that as an interpretative and critical tool when explicating the doctrines of those philosophers.

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Encyclopaedists

The French Encyclopaedists comprise a group of philosophers (including Montesquieu (1689–1755), Voltaire (1694–1778), Etienne Bonnot de Condillac (1715–80), Jean-Jacques Rousseau (1712–78)) centred around Denis Diderot's (1713–84) great undertaking of the *Encyclopédie* (1751–72). Its core consists of Diderot, Jean le Rond d'Alembert (1717–83), Claude-Adrien Helvétius (1715–71), and P.-H. T. d'Holbach (1723–89). Though their philosophies differ, prominence may be given to Holbach's ideas, since his *System of Nature* (1770), the 'bible of materialism', is the most comprehensive statement of philosophy in the spirit of the *Encyclopédie*.

According to Holbach, the universe consists of an infinitely diversified multitude of material bodies which constantly move and change. Matter can neither begin nor cease to exist; rather, it is the foundation of all coming to be and passing away. The latter take place according to invariable laws and in particular in such a way that the total amount of matter and movement remains forever the same. Nature is the great totality beyond which nothing can exist. Hence man is through and through a natural being. He originates in an almost imperceptible point that possesses no human qualities at all, and grows by the absorption of matter so that he finally becomes a thinking and acting being. Man's intelligence is his special type of organization, and even his morality is nothing other than his physical existence considered under a special point of view.

In nature things attract or repel each other according to the needs of their self-preservation. In moral life, correspondingly, self-love determines whether we love or hate a person. Our intellect allows us to contribute to our self-preservation in a conscious way. Man is therefore his own centre; he moreover tends to explain all natural occurrences resembling his own activities as activities of a (higher) type of intelligence: he posits God as cause of nature. Yet just as man's soul is the principle of the body's life and sensory powers – so that to separate body and soul would be to distinguish the brain from itself – so the principle of the universe is this very universe itself. The soul does not dwell outside the system of natural laws. Hence the will is not a spontaneous and free cause, but rather a consequence of many causes influencing man. This deterministic view is in fact presupposed by education, legislation, morality, and even by religion. Freedom is an illusion, and so is immortality. A virtuous man can do without them. He will do what is good for the benefit of his fellow-men, not because of any last judgement. The atheist is a moral person in a more serious sense than is the believer, for he is interested without reservation in his fellow-men, to whom he is linked by the same human nature they all share.

The other encyclopaedists deviate to a greater or lesser degree from these Holbachian views. D'Alembert is the most sceptic member of the group, and in fact also the only one to concede that God could possibly exist. All our ideas, including the mathematical ones, derive, as he sees it, from simple ideas given in sensation. Our natural feeling incites us to reach beyond our sensations and so we conclude to the existence of an independent world causing such sensations. Yet neither the existence of this world nor the essence of the matter of which it consists can be cognized with certainty. And in any case, matter (which we must conceive as inactive) could not be the origin of a spontaneous mind. Also the origin of movement in matter, and moreover the principles of morality, seem to be the work of a higher intelligent being. However, since moral life consists in good conduct towards our fellow-men, and since we are born for society, we are constructed in such a way as to know and to apply the moral principles without previous recourse to the idea of God.

Diderot is closest to Holbach. He, too, insists that the material universe exhausts the totality of what is. Everything is part of the universal chain of being and becoming, and man's specific abilities, too, must result from the general nature of the molecules that make up the universe. Matter cannot be merely passive, but must be endowed with (kinetic and potential) energy, and even with sensibility, i.e. with the possibility of having sensa-

tions. The coagulation of matter into organic units activates this sensibility, and this eternal process leads to the development of ever-changing species of animals.

Helvétius is more radically materialistic than is Holbach. The soul is the organism's physical principle of life. It is mechanically affected by objects (the intrinsic nature of which, as of matter and space in general, remains unknowable). The imprints of objects on the soul yield sensation, and it is from sensation that all ideas of objects derive: to judge, i.e. to compare ideas, is to sense. Ideas are left over from sensation and these make up the mind; the mind's processes are as mechanical as are those of nature in general. Self-love being the only innate sentiment, all morality is to be reduced to it as governed by the principle of pleasure. As matter is a collective name for the properties common to all bodies, so virtue is a name for the exercise of the self-love of all persons.

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Energeia/Dynamis

Energeia, for Aristotle, is equivalent to actuality, δύναμις to potentiality. More precisely, Aristotle distinguishes, in *Met.* V 12, between two uses of δυνατόν:

1. As a predicate, in the sense of 'potent'. This concept depends on that of power, which is defined as the "principle of change in another, or in so far as that thing is other" (1020a1–2).
2. As a statement-operator. A statement is 'possible' which is such that neither it nor its opposite is necessarily false (1019b28–33).

How these two concepts relate to each other and how the treatment of modal concepts in *De Int.* 12f. can be integrated with this distinction is a difficult problem of interpretation. The modal expressions of *De Int.* 12f. are to be understood as statement-operators (cf. 21b26–32). In the end, however, the statement-operator itself is traced back to the concept of potency (cf. Wolf 1979, p. 127). *De Int.* 12f. recognizes a broader concept of possibility, according to which the necessary too is possible; and a narrower one, according to which only that is possible which can also not be.

The Kinetic and the Ontological Concept of *Dynamis*. *Met.* IX 1 distinguishes between the (active) potency to do something and the (passive) potency to suffer something. Later, IX 2 distinguishes between irrational and rational potencies. The passive potency corresponds to the dispositional predicates of the contemporary discussion, the active to the predicates of power. Rational potencies – for example, art and applied science – can give rise to contraries. Thus, on the basis of his art, the doctor can produce health or sickness, because the concept of sickness is also given with that of health. Irrational potencies, on the other hand, are determined in every case to one effect.

The use of 'potency' is not limited to the potency to produce or to suffer change, although this is, for Aristotle, the most proper meaning (*Met.* IX 1, 1045b36). For predicates of all categories can belong to their substrate according either to possibility or to actuality (*Met.* V 7).

First Entelechy, *Kinesis* and *Energeia*. The ontological concepts of possibility and actuality do not admit of definition. They can only be illustrated by examples and must illuminate each other. "Actuality, then, is the existence of a thing not in the way which we express by 'potentiality'" (*Met.* 1048a30–32). Some examples are: the awake with respect

to the sleeping, the seeing to the one with his eyes closed, and the finished figure to the unworked block of wood. The first term stands to the second in each case in the relationship of being-according-to-actuality to being-according-to-possibility. This relationship is one of analogy. It can concern the relationship of movement to power or that of essence to material. So, a two-fold concept of ἐνέργεια results:

1. as a form of an essence (entelechy; *actus primus*), or
2. as operation (*actus secundus*).

Thus the form, as first entelechy, makes this matter to be lion; his life of eating, reproducing, growing, hunting, etc., constitute his proper operation or 'second actuality'.

The form can accordingly be understood as the potency with respect to the operation proper to the being in question (*Met.* IX 6, *De An.* II 1).

Actuality is ontologically prior to potentiality in a two-fold sense (*Met.* IX 8).

1. First, it is, as 'second act', the goal of potency. Aristotle distinguishes between operation (κίνησις) in the narrower sense and actuality (ἐνέργεια) in the narrower sense. The operation (for example, the activity of building) is oriented towards a goal different from that (i.e. the completed house), whose realization is at the same time its temporal end. The actuality (for example, seeing) produces nothing different from itself; it has nothing other than itself as goal and is in each moment complete (*Met.* 1048b18ff.; 1050a23ff.). It is in a more authentic sense the goal of a potency than is the operation.
2. The second sense in which actuality is prior to potency relates to a connection between the two concepts of the possible at *Met.* V 12. Every potency is indifferent with respect to its actuality; what is possible can both be and not be. That which can not-be is transitory. If there is something which is non-transitory and necessary, that being cannot be possible, at least in the sense that it can either have or not have its actuality; its being, therefore, can only be in the mode of actuality. Without such a necessary nature, there would be nothing.

Under the influence of the Christian doctrine of creation, these considerations lead in Scholasticism to the concept of God as *actus purus*. Thomas Aquinas distinguishes, along with form, also *essentia* and *esse*, between which there obtains a relationship of potency and actuality (*Sum. Theol.* I.3, 4). Being (*esse*) is the *actualitas omnium actuum* and the *perfectio omnium perfectionum* (*De Pot.* 7, 2 ad 9). Even in created immaterial spiritual substances there is found a composition of actuality and potency. Only one thing can be subsistent being (*esse subsistens*) (*Sum. Contra Gent.* II 52f.).

See also: **Potentia/Actus**

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Ens a se

Ens a se (being in itself) refers to a being that is self-sufficient. Because it is self-sufficient, it is absolutely independent of every other being and hence has no relation to any other being, although other things are related to it, according to the medieval view of relations. (On the medieval view, it is not true that for every relation there is a converse relation. Creatures are related to God, but not vice versa.) Since it depends on nothing for its existence, *ens a se* exists in *se* (in itself). In contrast, *ens ab alio* is a being that depends

upon another being for its existence. Since it is an empirical fact that at least one being is *ens ab alio*, there must be at least one being that is *ens a se*; for if there were no *ens a se*, then there would be an infinite series of *entia ab aliis* that would lack an explanatory basis and there cannot be such a thing, according to the medieval view. That is to say, since each member of the series would depend for its explanation upon some prior member of the series which would itself require explanation, none of the members of the series would have an explanatory value at all unless there were a first member that did not need any explanation but served as an explanation for the second member and the foundation for the explanation of every other member. For example, if the stability of the earth required an explanation, it would not be legitimate to argue that the earth rests upon the back of an elephant that stands on the back of a tortoise that stands on the back of a tortoise *ad infinitum*. All medieval thinkers identified *ens a se* with the Judaeo-Christian God.

The sense in which *ens a se* is absolutely independent can be understood in contrast with the sense in which creatures are absolutely dependent on God for their existence. Where '*x* depends on *y*' means '*x* is at least partially caused by *y*', *x* is absolutely dependent on *y* just in case *x* depends on *y*; *y* does not depend on *x*; and *x* depends on nothing other than *y*. This explication entails that an absolutely dependent being does not depend upon itself in any way; in other words, neither its existence nor any of its properties come from itself. The relation of absolute dependence then is irreflexive and asymmetrical. It is also intransitive. The proof goes by way of *reductio ad absurdum*. Suppose that absolute dependence is not intransitive. Then, where *R* means absolute dependence, there must be some assignment of values for *x*, *y*, and *z*, such that the formula, 'If *xRy* and *yRz*, then not *xRz*', comes out false; that is, an assignment of values that makes the antecedent true and the consequent false. But every assignment of values that makes the consequent false makes the antecedent false also and hence the entire formula true, for to make the consequent false, *x* must be absolutely dependent on *z*. And if *x* is absolutely dependent on *z*, then *x* is dependent on nothing else, in particular, not on *y*. Hence, *xRy* is false and the entire formula is true. (If *y* should be identical with *z*, then although *xRy* will be true, the other conjunct of the antecedent, *yRz*, will be false.) Thus, absolute dependence is not not intransitive; consequently, it is intransitive.

Ens a se and *ens ab alio* are philosophical concepts that developed from the idea of a God who is a Creator. God, who is self-sufficient in a strict sense, creates *ex nihilo* (from nothing) and depends upon nothing for his creative activity, not even upon a pre-existing matter or chaos. Since creatures in being created are absolutely dependent on God for their existence and hence for all of their properties, they owe everything to God. This is the ontological basis upon which medieval thinkers argued that God is owed absolute obedience.

The idea of *ens a se* raises various problems for those who want to affirm various common-sense views such as human freedom. For if humans, being creatures, receive both their existence and properties from God, none of their actions can be their own in any sense sufficiently strong to ground human freedom. Medieval philosophers tried various ways to reconcile the absolute dependence of creatures with freedom.

Spinoza took the scholastic and medieval idea of *ens a se* and drew revolutionary consequences from it. Defining substance as *ens a se*, he inferred that there can be only one substance, because it is self-sufficient, and hence that everything depends on that thing. This leads further to his denial of freedom of action to anything but the one substance. *Ens ab alio*, in his technical language, is a 'mode', an affection of substance, either mind or matter in general or individual objects and events in particular.

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Ens Rationis
I: Medieval Theories

"Being is twofold, of reason namely and of nature" (Thomas Aquinas, 1225–74, *In IV Met.* 4, 574). A being of reason (e.g. genus, species, negation, the future) has no existence except in human thought. Its *truly* having existence there is what is stressed by the notion of an *ens rationis*. These products of reason are, *qua* such products, beings, since they are knowable, for "whatever is understood must actually be" (*In IX Met.* 10, 1894). So for Aquinas *entia rationis* are *wirklich*, rather than forming a class of non-actual objects in the manner of Gottlob Frege and his school; they exercise acts of being, *actus essendi*, albeit in the mind alone.

The whole being of an *ens rationis* consists in its being understood, as 'object' of knowledge. Whether through cognition or through volition, the mind makes exist ideally what of itself cannot exist. Such a being, like the merely possible, has a formal but no efficient cause. The foundation of *entia rationis* in either reality or libido is not the essential division of them for Aquinas, however; this is rather between negations and relations (*De Pot.* 9, 7; *De Ver.* 21, 1c). A negation, non-being, becomes an *ens rationis* from being necessarily considered as if it were a being (*ad modum entis*, cf. *In IX Met.*, 889).

Among what is positive, by contrast, nothing actual seems incapable of real existence in the sense defined, whether as substance or accident, except for certain *relations*, in so far as they may be *ad aliquid*, i.e. *of* or rather *towards* something, without being really *in* that thing. An example might be knowledge: when I know something I truly have a relation to (*ad*) it, but not so as to affect it in its own being. These are *relationes rationis (seu logicae) secundum esse* (Gredt 1937, p. 154).

Under negation is included unity, as denying division to being, and contradictions such as square circles. Dreams and fictions are assimilated to this class; although they are real as states of the soul and as matter for psychology or aesthetic enjoyment, they are in themselves the opposite (negation) of what is real, and yet they are not thereby nothing. The future too, as future, is, like dreams *qua* dreams, actual in thought alone; it is not (yet).

These are the *entia rationis sine fundamento in re*. Those *cum fundamento in re* fall into two main groups, having either an immediate and proximate or, second, a mediate and remote foundation in reality (Aquinas, *In I Sent.* 2, 1, 3 sol). Examples are the entities conceived by Aristotle, Avicenna, and Aquinas as forming the objects of the science of logic. Where the proximate foundation of the entity is itself in the intellect (*in mente sola*) the foundation in reality is called remote.

Examples of entities which are founded in reality but not themselves real are the acts of reason, triply grouped by Aristotle as concepts, judgements, and syllogisms (*De An.* III). These, it is argued, must be relations. They are immediately and 'proximately' founded in reality as similitudes of it in the ways distinctive of each of these three types of act. Among concepts examples are those of man or stone (Aquinas, *In I Sent.* 19, 5, 1 sol) but also of truth (ibid. 2, 1, 3 sol) or time.

To say concepts and the other mental acts are relations is to make them the weakest form of accident. A relation is not *aliquid*, is not a something. For John of St. Thomas such entities are 'formal signs'; their being is exhausted by their signifying relation, hence no previous 'objective' knowledge of them in themselves is required to know what they signify (*Ars logica* II, q. 21–3). Thus, for example, a concept is a relation of the intellect or person to something real, real in the mind even in the case of error. It is in this sense a 'first intention'.

The second group of *entia rationis cum fundamento in re*, or of concepts of logic only remotely founded in reality, are the *second* intentions of the mind: intentions of (the first) intentions; they are concepts of con-

cepts, and therefore also relations of such relations, i.e. the mind relates itself to its previous (first) relation to what it conceives. It does not consider itself doing this, as in psychology, but considers the thing or form understood *as understood* and not as the thing itself is. Thus, for example, the intellect devises (*adinvenit*) the intention or concept of *genus*, which it applies, say, to animality since it understands animals in many different species, yet it is not thereby false to the reality, which still remotely founds the given concept.

In accordance with this, the existence of *entia rationis* is accounted for by the doctrine of the four transcendental or first concepts, viz. being, unity, truth, goodness. Unity, we saw, adds negation (of division) to being, as "that which is consequent upon every being" (Aquinas, *Sum. Theol.* I, 11, 1). The general point is that the three transcendentals besides being must either be identical with being or else be distinguished from it only by adding something which being itself does not already include, i.e. something of reason only (negation, relation of reason). For if they included more, they would not be primary concepts, like being, but secondary and derivative. This then can only be a case of what results through the adding of something *secundum rationem tantum*, i.e. according to some relation of reason not importing real being, just as negation does not import it. This relation must, however, be to something referred by its nature to being universally, such as the human intellect or will. Being as related (by our thought) to intellect is truth; being as related (by our thought) to will is goodness (Aquinas, *De Pot.* 9, 7 ad 6). Thus the true and the good, as adding only a relation (of reason) to being, are not really separate from it. There is, by this doctrine, no autonomous realm of value, and neither is there any realm of epistemic formalities unrelated to the real. Beings as they are related to the intellect or will – as objects of thought or desire – become, precisely like these 'intentions', beings of reason.

It follows that in this tradition logic deals with second intentions, or thoughts of thought, as *acts* of the understanding (cf. Aristotle, *De Int.* I), not, primarily with words or *sermo* (cf. Kretzmann 1968). "The subject matter of logic . . . is intentions understood secondarily, which are applied to intentions primarily understood" (Avicenna, *Philosophia prima* I, 2, f.70vA; cf. Veatch 1970).

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STEPHEN THERON

Ens Rationis II: From the Medievals to Brentano

An *ens rationis* or being of reason exists merely as an object of thought. *Entia rationis* include:

1. *Fictions*, things whose existence is ruled out as improbable or impossible. Mythical beings, arbitrarily characterized objects, and even theoretical constructs fall in this class. Fictions are said to be without a foundation in reality.

A foundation in reality is ascribed to *entia rationis* in the next two generally negative classes.

2. *Privatives*, such as blindness and lack of ventilation.
3. *Negatives*, negatively conceived objects such as non-liquids – or better, non-liquidity, for in this class, as with the privatives, what is absent in reality is something inherent rather than something substantial. Any *ens rationis* is a fiction in the general sense of a mental construct. It enables our knowledge to circumvent its natural orientation to being and to have an object where none is provided by nature. By its role in a

true proposition, it enters into our knowledge as a real object does. That much is conceded, when one says that it has *ens rationis*, or is an *ens rationis*.

4. *Entia rationis* also include *relations of reason*. As opposed to *real relations*, a relation of reason has a subject or term that is not real, or not really distinct from the other member; or the relation is not founded in anything real in its subject. Among relations of reason are the *predicables*, the roles in which a nature can be related to other natures or to individuals – viz., as genus, species, differentia, property, or accident. As for the status of individuals, unless these are conceived metaphysically and identified as substances, we have to do here with just another relation of reason, namely the role in which something is related to a species or to a predicated property. Relations of reason are associated with each of the three operations of the understanding. The preceding relations are associated with prejudgemental apprehension of an object by means of a concept (simple apprehension). Examples of relations of reason for the other operations of the understanding are propositions (for judgement) and ground or consequent (for inference).

The *formal concept* in simple apprehension is abstracted from our experience and is the means for apprehending something. But the *objective concept* is what one has in mind or intends with regard to the thing that is apprehended; it is the intended nature of the thing. As intended in the very apprehension of the thing rather than through some supervening reflection, it is called a *first intention*. As the nature common to many of the individuals one apprehends, it is the *direct universal*. It can be presented as an object obliquely, namely when one reflects upon one's intending; it then appears as the term of the intending, i.e., the sort of thing one has in mind. And then we can apprehend it in its relations to other natures and to individuals. These relations are called *second intentions*: of what we intend with regard to things of a certain class, we now intend the relations of universality that it has to those things or to their more or less specific natures. These second intentions are always relations of reason, and therefore *entia rationis*.

Relations of reason are sometimes said to include *extrinsic denominations*. That expression is taken in a narrow sense, as meaning just a determination that consists in some experience's being directed at a thing. Thus, if someone sees a thing, then the extrinsic denomination is being seen; and if someone loves it, then the extrinsic denomination is being loved; and so on. Yet being loved is probably not a relation of reason, even apart from its qualifications as a real relation; for it is not a second intention. Thus, one needn't conceive of Sam *in obliquo* to think of him as loved by Betty. On the other hand, if one thinks confusedly of 'the beloved of Betty', then the occasion is undeniably right for a second-intention diagnosis, but then the second intention is being identical with Sam, not being loved by Betty.

Not all of the cited cases of extrinsic denomination fail as *entia rationis*; signs are cited by Joachim Jungius, and these are quite satisfactory. Anyway, if one already suspects that '*to constitute*' is the preferred replacement for 'to be', when *ens rationis* is being predicated then many suitable cases come to mind. Such-and-such a thing constitutes a sign of autumn. Planet *a* and Planet *b* constitute one and the same planet. Bears constitute a class by themselves. This constitutes the entire shipment. That bridge constitutes a public menace. And so on. More clearly than 'is' (which can always be used) the *copula* 'constitutes' suggests a thin version of being in which objective significance appears as the analogue and competitor of reality, or perhaps as the pale cast of thought over it. Always more or less dimly reflected in this overlay of mind-relative being is some sort of qualified observer who takes some intellectual or emotional position with regard to the thing under consideration. He infers that autumn is approaching, for example. So in these cases, *ens rationis* does indeed coincide with an extrinsic denomination of the thing.

A more rudimentary idea is evoked by the Brentanian use of '*ens rationis*'. This is the idea of an object-type that is conventionally

added to 'what there is', but which can be discarded as soon as one really understands thought and language. That sounds like entity-reducing, but in fact the Brentanians (including Franz Brentano himself, even in his last philosophical period) prefer to redirect us to a reduced entity, one that cannot seriously be taken as an adjunct to what there is. As they proceed, no more is heard about *entia rationis*; yet what they arrive at is an *ens rationis* in the sense of the preceding paragraph. Consider existence, for example. According to Brentano and Anton Marty, to represent the existence of a thing *a*, one represents *a* as the object of a justified judgement. The existence of *a is* the thing's admitting of such a judgement, its meriting acknowledgement. Thus, the state of affairs called 'the existence of *a*' has been reduced to an extrinsic denomination. After the turn of the century, Brentano shifts the emphasis on epistemic merit from the object to the judgement, where it becomes the notion of *Evidenz*, insightfulness. According to Brentano's final view, then, the thought of a thing's existence is the thought that it would be judgementally accepted or acknowledged by one who judged with evidence.

In general, then, there is a characteristically Brentanian approach to existence, modality, negation, and value which treats these as extrinsic denominations of a thing relative to someone who accords the thing an intellectual or emotional acceptance, an acceptance that is justified (or even insightful, if the acceptance is intellectual, i.e., judgemental). And surely this is an '*ens rationis*' approach. The *ens rationis* approach is not the approach of the opponents, Alexius Meinong and his colleagues, who disdain the appeal to reflective acts that they deem unverifiable. Now, as far as the opponents are mistaken in thinking that they apprehend some state of affairs such as the existence of *a*, that just means that *a*'s existence is not something 'pre-given' and apprehensible without reflection, which is the way the opponents interpret it. But it is at least confusing, when the Brentanians give the name '*ens rationis*' to the existence of *a*, interpreted Meinong's way, without also giving this name to the existence of *a* interpreted in the Brentanian way, which is the *ens rationis* way.

Where the imagined existential judgement is a generally intended one like 'There are honest men', rather than a definitely intended one like 'There is a newspaper on the table', the Brentanian approach to existence has a rival or an obligatory partner in another *ens rationis* approach. According to this approach, the fact of there being honest men is a fact about the objective concept of an honest man, namely that something fits it. Now say that the rationate relation of *fitting* is transferred from the domain of objective concepts to that of statement-functions; then one has the existence of honest men consisting in the fact that something fits the remark, 'That man is honest'. But in this case, the relation of fitting is just the converse of *being true of*, and one is reminded of how often *ens rationis* seems to be a matter of being *qua* truth.

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Entia Successiva

Augustine (*Confessions* IV, 10–11) suggested in passing that the universe is composed of successively existing parts: "This is the way of things . . . by passing away and succeeding one another, they constitute the universe of which they are all parts". That is, he suggested that the universe is an *ens successivum*. This suggestion raises two questions:

(1) Are there other *entia successiva* (hereinafter, *esa*) than the universe?

(2) Whatever things may be called *esa*, do 'they' really exist, or is apparent reference to 'them' merely a device for describing the relations that 'their' successively existing parts bear to one another?

(Aristotle had in effect suggested that periods of time are *esa* and that finite – but not infinite – periods of time are 'real' *esa*. See *Phys.* 206a. We shall consider these two questions only in relation to material things.)

These questions have become important in 20th-century metaphysics, owing to philosophical reflection on the incompatibility of the following two individually plausible theses:

1. Material things sometimes change their parts with the passage of time.
2. The parts of a material object are essential to its identity (*mereological essentialism*).

Mereological essentials are aware that we talk as if the same oak were composed of different particles at different times, but they insist that this is a mere manner of speaking. They hold (following Bishop Joseph Butler, 1692–1752) that 'identical' has two senses; that one may say of aggregates of particles that are 'identical in the loose and popular sense' that they are nevertheless not 'identical in the strict and philosophical sense'.

Roderick M. Chisholm (1976) has employed the term '*ens successivum*' in the course of an attempt to make this idea precise. He answers our two questions, in reverse order, as follows:

(2) Owing to the truth of mereological essentialism, there are *really* no *esa*; *esa* are mere fictions whose existence we feign as a device for describing the mutual relations of 'their' successively existing parts.

(1) In whatever sense fictions 'are', there are many *esa* besides the universe. For example, there really are enduring tables, but – owing to the demands of mereological essentialism – their existence is typically very brief; we *feign* the existence of *esa*: 'long-lived' tables whose (largest) successively existing parts are the 'brief' tables (and which have at any instant the momentary properties of whichever of their 'brief table-parts' exists at that instant).

Chisholm's theory of *esa* consists mainly of an attempt to show how to translate sentences apparently about tables that change their parts with the passage of time (sentences we should normally say expressed truths) into sentences that refer only to tables (typically, 'brief' tables) that do not change their parts with the passage of time.

Chisholm's theory of *esa* presupposes:

1. that material things are three-dimensional objects that endure – however briefly – through time, and
2. mereological essentialism.

If, however, as many philosophers believe, tables are four-dimensional, extended in time as well as in space, one may consistently hold both a 'four-dimensional' version of mereological essentialism (that the four-dimensional parts of a four-dimensional object belong to it essentially) and the thesis that a four-dimensional object has different three-dimensional parts at different times. As to mereological essentialism, there would seem to be no non-circular arguments for its truth. Moreover, anyone who accepts this principle must accept at least one of the following four unattractive theses:

a. there are, in the strict and philosophical sense, no persons;
b. persons last only for very brief intervals;
c. persons have no proper parts;
d. persons always have the same parts.

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Epicurus

Epicurus (341–271 BC) became interested in philosophy at the age of 14 and successively studied with philosophers from various schools of thought. It appears that for some time at least he was particularly impressed both with Nausiphanes (born *c.* 360 BC), an adherent of the school of Democritus, in which questions concerning perception and reality were discussed, and with Pyrrho (*c.* 360–*c.* 270 BC), the founder of scepticism, who is reported to have claimed that impressions (φαντασίαι) *and* judgements (δόξαι) alike are neither true nor false. The former's teaching may have alerted Epicurus to the problem raised by Democritus (*c.* 460–*c.* 370 BC) over the question of how to reconcile the claims of reason with the evidence provided by the senses. Acquaintance with the latter, who was a man of great reputation, is likely to have contributed to the insight shared by most philosophers in Hellenistic times that philosophy ought to concern itself with matters of human well-being (εὐδαιμονία). This view, which had been characteristically associated with Socrates' demand that the philosopher consider himself to be a doctor of the soul, became the cornerstone of Epicurus's conception of what philosophy is all about. In fact he professed that philosophy is not worth anything unless it succeeds in freeing one's mind from fear and liberating it from all kinds of vain ideas that tend to make man's life miserable. Thus much of what he explicitly said, as well as much of what he presupposed, must be judged in the light of this desired therapeutic effect (θεραπεία τῆς ψυχῆς).

Although he did not think highly of logic and science, Epicurus tried hard to establish a scientific method (i.e. the principles of verification and falsification), designed to provide firm ground for the statements concerning the true nature of the world and thus help him to realize his ideal of therapeutic philosophy. Considering that men seem to worry not only about death and the afterlife but also about the gods of popular religion, mistaking natural phenomena for events caused by divine powers interfering in mundane matters, Epicurus emphasized the notion of blind causality and advocated a purely materialist ontology devoid of any metaphysical residue and hidden meaning. To that effect he rescued atomism from the attacks levied by Aristotle against Democritus. Moreover, he attempted to outline a system of ethics based solely upon an empiricist approach toward knowledge, claiming, in fact, that we already possess an unerring perception of what is good and what is bad.

Epicurus divided philosophy into three parts: ethics, physics, and the axiomatic part (κανονικόν). In the axiomatic part he insists that what matters most is that one remain with the content of perception. In fast Epicurus claimed that all impressions (φαντασίαι) are true and that error and falsity enter in only when the cognizing subject adds something (προσδοξαζόμενον) to what is given by the senses themselves. This theory is not an easy one to understand and attracted much controversy. For it looks as though Epicurus, when arguing that "all sensation (αἴσθησις) is irrational (ἄλογος)" (*Us. fr.* 36) and unable to "err" (*Us. fr.* 247), must be actually thinking of facts of experience that are incorrigible. However, from the point he makes to the effect that sensation as such does not add or subtract anything (*Us. fr.* 36) – a point referred to by Hegel in his critique of sensual certainty in the *Phenomenology* – it is clear that what the claim "all perceptions are true" (*Us. fr.* 247) amounts to, is that perception (or sensation, for that matter) represents things correctly in that it conveys just what it is like out there.

Epicurus held that whatever it is that we experience stems from an imprint imposed by some external thing by means of an image (εἴδωλον) thrown off by the object. His point here is somewhat unclear. In any case, he insists that as long as we stay with what the senses report we are not open to error. The possibility of error arises when we add something to what is given or connect the content of perception with something not given by the senses. At this point it looks as if Epicurus were thinking (along the lines of René Descartes, *Meditations* III §§ 5–6) that truth and falsity proper occur when we attempt to refer the content of perception to some item in the world. Thus Epicurus may have

thought of statements such as 'This is Socrates' or rather 'The white (thing there) is Socrates' which Aristotle had used as cases of incidental perception liable to truth or falsity. However, Epicurus may also have been thinking of value judgements and the like, which may be both mistaken and groundless in that what they report as being such and such is not (or even cannot ever be) the content of perception. Once a judgement has been confirmed (ἐπιμαρτύρησις) on the basis of sense experience, it is to be considered evident; once it has been disconfirmed (ἀντιμαρτύρησις) it is to be considered false.

Ethics. Epicurus claimed that pleasure (ἡδονή) is the highest good. This seemed so obvious to him that he did not really think he had to provide proof. However, the Epicureans occasionally pointed out that the perception of pleasure as something good becomes evident once we turn to new-born children and animals and recognize that, their nature being yet uncorrupted, they pursue what gives them pleasure and shrink from whatever gives them pain (*Us. fr.* 398). This point connects ethics with the empiricist account of knowledge, in that animals and new-born children alike do not add anything to what is given in perception or provided by the senses. What makes things difficult, however, is that the Epicureans, although they conceived sensations as something irrational (ἄλογος) in the sense of being non-propositional in character, did not hesitate to describe the perception of good and bad as something judgemental (*Us. fr.* 398).

As for the notion of pleasure, it is interesting to see that Epicurus held that it consisted simply in absence of pain. He thereby differs from the Cyrenaic School of Aristippus (*c.*435 – *c.*356 BC) and other theorists of pleasure, and uses the word 'hedone' (ἡδονή) in a rather idiosyncratic way. This may be explained by reference to the fact that Epicurus himself suffered from pain for most of his life. It is hard to see, however, how such a conception of pleasure could be reconciled with ordinary intuitions. Even given an alternative conception, however, Epicurus would have still been liable to the charge of having moved from the assertion that every living being strives after pleasure, to the assertion that there is one pleasure after which every living being strives.

Among other doctrines put forward by Epicurus is the claim that death is nothing to us (*Us. fr.* 139 and *fr.* 124). In view of the scanty evidence, it is perhaps difficult to see what this claim comes down to. If Epicurus merely wanted to say that being dead we cannot experience anything and for that reason do not have to worry about what may come next, he may have been successful in dispelling superstitious fears on the part of those who kept worrying about the afterlife. In pointing out that all evil is 'in sensation' (*Us. fr.* 124), he may have intended to convince his students that death is not the sort of thing that can be experienced as evil in the first place. This may well be consistent with what he has to say concerning the actual perception of good and evil. But it does not look like a successful attempt to alleviate the fear of dying.

Physics. Proceeding from the assumptions

1. that nothing comes out of nothing,
2. that nothing turns into nothing, and
3. that there is a level of constancy in the universe,

Epicurus argued to the effect that the world of experience can be accounted for only on the basis of an atomist ontology. As far as ancient philosophy is concerned, such a claim would seem to run counter to the sensualist attitude and thus was in need of a good deal of explaining. Epicurus had to develop a rather strict methodology, one that would permit him to cast judgement upon things not accessible to sense experience. Thus in addition to the above-mentioned principle to the effect that statements addressing themselves to some observable event, in order to be recognized as being true of the world, had to be confirmed directly (ἐπιμαρτύρησις), Epicurus advocated a second principle that would furnish indirect evidence. This he called the principle of 'lack of contrary evidence' (οὐκ ἀντιμαρτύρησις). Apparently it was meant to establish that a given hypothesis is consistent with the phenomena. Thus the existence of the void (*Q*) has been inferred from the fact that there is motion (*P*) and that

motion presupposes the existence of the void. In Epicurus's view non-Q would be falsified by the phenomena (*Us. fr.* 40). However, it is obvious that the method of indirect confirmation cannot be considered a satisfactory procedure since there are cases where a proposition non-Q is not falsified by the phenomena or where alternative hypotheses are all equally consistent with the phenomena but exclude each other. From later accounts of Epicureanism it can be shown that critics did not fail to notice those points and sought appropriate amendments.

As concerns the details of Epicurus's physical theory there are at least three areas in which deviations from the atomism of Democritus and Leucippus (fl. *c.* 450 BC) become apparent.

First, Epicurus held that atoms are not theoretically indivisible and hence are to be distinguished from 'smallest parts' which are absolutely indivisible. This notion was in conflict with the mathematical doctrine of his own day but seemed to have been required by Epicurus at least for this reason: that it is in virtue of having parts of some kind that things can get in touch with one another. Thus if the world was to be one made up from compounds of atoms, it is clear that the atoms themselves, being the ultimate constituents of the compounds, must be considered as having parts.

Second, Epicurus held that the atoms, apart from possessing shape and size, also have weight and thus naturally fall downwards, movements in other directions being imagined to result from collisions between atoms. But if all atoms are, by their own weight, engaged in a downward movement, how could such collisions come about in the first place?

Third, Epicurus says that this happens because some one of the atoms, apparently for no reason whatsoever, deviated from its course and thereby swerved into another, causing it to change its direction. This doctrine has been held to be unintelligible by many critics and met with harsh criticism even in antiquity. Yet it is likely to have served an important role within Epicurean thought. On the one hand it bears witness to the characteristic assumption that the universe as a whole is, in the last analysis, the product of blind chance (τύχη). On the other hand, the notion of *swerve* as a break in the chain of events permitted the Epicureans to entertain the idea that personal efforts on behalf of our own well-being are possible. Since freedom of will had been considered a fact (*cf.* Lucretius, *De rerum natura* II, 216 sqq.) and must be presupposed if philosophy is to lead anywhere at all, there has to be some kind of break in the chain of events. It is in virtue of this assumption that human beings may be considered as agents, that is, as causes of their actions. What remains unclear, though, is whether Epicurus thought that each free action requires swerve of its own.

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Eriugena. See: John Scottus Eriugena

Essentialism

An *essentialist* holds that some objects have some properties *essentially*, where an object x has a property P essentially if and only if it is not possible that x exist and lack P. More exactly, the essentialist holds that some or all objects have *non-trivial* essential properties, where a property is non-trivially essential to an object if it is essential to that object, and not essential to everything. Here the notion of possibility in question is that of broadly logical possibility and necessity: the sense in

which it is possible, let's say, that Descartes should have swum the Atlantic but not possible that he should have drawn a round square. (There is also, of course, a perfectly good sense in which it is *not* possible that Descartes should have swum the Atlantic; 17th-century intellectuals, as opposed to great white sharks, simply lacked the physical equipment for such a feat.) Alternatively put, a property P is essential to x if x has P in every possible world in which x exists; P is accidental to x if x has it, but does not have it in every world in which it exists. The properties *being self-identical* and *being unmarried if a bachelor* will be essential to everything; the property of being prime, on the other hand, will be essential to (say) the number 7 but not to the number 8. The property of being a person will (arguably) be essential to all persons; the property of wearing shoes will not be essential to anything that has it. A statement to the effect that some object(s) has (have) some property essentially – *human beings are essentially persons*, for example, or *9 is essentially composite* – is a statement of modality *de re*. An interesting special case of modality *de re* is presented by statements of modality *de dicto*. These are statements that predicate a modality – necessary truth, or possibility, or impossibility – of some other statement: *9 is composite is necessary* and *some human beings are prime numbers is impossible* would be examples. (These are statements of modality *de re* in that they predicate the essential possession of truth or the essential possession of falsehood of some object or objects: the first predicates necessary truth of *9 is composite*; the second predicates impossibility of *some human beings are prime numbers*.)

Some philosophers have been notably cool towards essentialism, but for reasons that seem obscure or unsatisfactory upon analysis. Thus W. V. O. Quine offers arguments for the conclusion that essentialism is false or confused; these arguments, however, depend upon explaining or defining modality *de re* in terms of modality *de dicto* in a way the essentialist would reject out of hand. Some philosophers apparently believe that empiricism requires the rejection of essentialism, but again, it is not at all easy to see why.

Individual Essences. *Individual essences* (hereafter 'essences') offer a special case of essential properties. Such essences are ordinarily thought of as follows: an essence E of an object x is a property essential to it and essentially unique to it, in the sense that it is not possible that there be something distinct from x that has E. In terms of possible worlds, E is an essence of an object x if and only if E is essential to x and such that in no possible world does there exist an object distinct from x that has E. Essences may have been recognized as far back as Aristotle, but were certainly recognized by Boethius, who says:

> For were it permitted to fabricate a name, I would call that certain quality, singular and incommunicable to any other subsistent, by its fabricated name, so that the form of what is proposed would become clearer. For let the incommunicable property of Plato be called 'Platonity'. For we can call this quality 'Platonity' by a fabricated word, in the way in which we call the quality of man 'humanity'. Therefore, this Platonity is one man's alone, and this not just anyone's, but Plato's. For 'Plato' points out a one and definite substance, and property, that cannot come together in another. (*Librum de interpretatione editio secunda*, PL 64, 462d–464c)

Essences were also, of course, recognized by John Duns Scotus, who referred to them as "*haecceities*", 'thisnesses'. There is such a thing, thought Scotus, as the property of being *this* very object – where one is pointing to a human being or animal or other object. After a considerable period of eclipse, essences are once again playing an important role in contemporary philosophy – ironically enough, partly through the efforts of the Logical Positivists, who hardly thought of themselves as friends of essences. The positivists emphasized and insisted upon the importance of logic and formal methods for philosophy; this led to renewed interest in modal logic and its semantics, and from here it was but a short step to essences.

If we think objects do indeed have essences, it will be plausible to suppose that an object will have several distinct essences. Thus among the essences of the number 9 will be *being the successor of 8*, *being the sixth root of* 43,046,721, and *being the definite integral of* x^2 *dx from* 0 *to* 3. (These are plausibly thought to be *different* properties: for any

pair of them, a person might be acquainted with or have a grasp of the first member of the pair without being acquainted with or having a grasp of the second.) Indeed, for any distinct properties unique to an object, there will be distinct essences of that object. To see why, begin by naming the actual world 'α'. Next, note that objects have *world-indexed* properties, properties of the form *having P in W*, where *P* is a property and *W* a possible world, and where an object *x* has a property *P* in a world *W* if it is necessary that if *W* had been actual, then *x* would have had *P*. (Thus, for example, the property of being snub-nosed in *W*, for some possible world *W*, is the property a person has if necessarily, if *W* had been actual, then he would have been snub-nosed.) Of course *W* can be the actual world: Socrates has the property of being snub-nosed in α. Now of course α is a possible world and therefore a (maximal) state of affairs or proposition. Given that true statements of the form *P entails Q* are necessarily true, it follows that the property *being snub-nosed in* α is essential to Socrates; while he could have failed to be snub-nosed, he could not have failed to be snub-nosed in α. Where *P* is a property, call 'having *P* in α' the α-transform of *P*. And now note that the α-transform of a property that is unique to an object will be an essence of that object: it will be essential to it (by virtue of being a world-indexed property), and also essentially unique to it, as a little reflection will reveal. α-transforms of distinct properties will themselves be distinct; so any given object will have at least as many distinct essences as there are properties in fact unique to it.

An interesting question is whether there are *qualitative* individual essences in addition to haecceities. Contrast two sorts of properties. First, consider *quidditative* properties, such as Boethius's Platonity (i.e., the property of being Plato) or the property *being wiser than Plato*, or *being 2 feet to the left of Socrates*, or *being older than Sam*: these properties involve some individual (such as Socrates or Plato or Sam) in a way that is reasonably clear but hard to characterize in a non-trivial manner. Contrast these properties with *qualitative* properties, such as redness, or wisdom, or unpunctuality, or *being more than 5 feet tall* – properties that do not involve a reference to some specific individual. The question is whether objects have qualitative essences as well as haecceities, where a qualitative essence would be a property constructed out of qualitative properties.

This question is connected with the question of *existentialism*. The existentialist (in the present sense) holds that existence precedes essence (or at any rate is not preceded by it); haecceities such as *being Socrates*, singular propositions such as *Socrates is wise*, and states of affairs that involve Socrates, such as *Socrates being short* are then *ontologically dependent* upon the individuals they involve: that is, they could not have existed if those individuals had not existed. In terms of possible worlds: any world in which an haecceity of Socrates exists is a world in which Socrates exists; and the same goes for singular propositions and states of affairs that involve him. The basic intuition here is that there simply could not have been such a thing as the property of *being this very thing* (where we are referring to some specific object such as a person) if the thing in question had not existed. This intuition, of course, is specific to the sorts of properties in question – i.e., quidditative properties; qualitative properties (redness and wisdom, for example) could have existed (so one reasonably thinks) even if their extensions had been different and even if they had not been exemplified at all. If existentialism is correct, then possible worlds are not necessary beings: if Socrates had not existed, neither would any of the uncountably many possible worlds in which he exists. But if individuals have qualitative essences, then existentialism is much less significant. For then objects would have haecceities, which would be ontologically dependent upon them, all right, but they would also have qualitative individual essences which would not be thus dependent upon them. And hence while some of the worlds in which Socrates exists – the ones that involve his haecceities – would be ontologically dependent upon him, there would be other possible worlds logically equivalent to them that would not be thus dependent upon him: those that involve his qualitative essences.

In addition to their own intrinsic attractiveness, essences are useful in several areas of philosophy. In philosophy of religion, they are useful for giving exact statement to the Free Will Defence and to the Ontological Argument. They are also useful in the philosophy of language: it is plausible to think, for example, that proper names express essences. They can help us understand negative existential statements; they can also help us understand predication. Essences also figure into the semantics of quantified modal logic. In the usual Kripke-style semantics, there is a great set U that (from the point of view of the intended applied semantics) contains all the objects that exist in any possible world. But this way of looking at the matter suggests that in addition to all the things that exist, there are some more things – the golden mountain, perhaps – that do not exist (in fact) but could have existed; these are *possibilia*. But *possibilia* are creatures of darkness; the supposition that in addition to all the things that exist there are some merely possible objects is dubious in the extreme. (There could have been things distinct from each of the things that does in fact exist; it scarcely follows that there are some things that do not exist but could have.) If we think of U as a set of essences (instead of concrete objects) then the above *suggestio falsi* imputed to the usual semantics of modal logic disappears.

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Euclid of Megara

The philosopher Euclid (not to be confused with the mathematician of the same name) was, according to recent estimates, born in Megara in 435 BC and died there in 365 BC. After studying Parmenides's philosophical theories, he became a student of Socrates (Plato, *Phaedo* 59 b–c). After his master's death, he returned to Megara, where he founded a school – known as the Megaric – that became famous for the ability of its members in dialectic.

Euclid was the first philosopher to attempt a synthesis of Socratic ethics and Eleatic ontology. He held that there was just one Good and that it was to be identified with unity, conceived as bearing the character the Eleatics attributed to being, that is the character of absolute and motionless coincidence with itself. At the same time, he denied the reality of that which is opposed to the Good.

There are two fundamental interpretations of Euclid's philosophy. According to the first, (A), he reduced the whole of reality to the One-Good: thus the supreme ethical-ontological dignity of the Good was translated into a radical ontological monism within which there was no room whatsoever for 'alterity' or 'diversity'. According to the other interpretation, (B), Euclid conceived the one Good to be the being of every essence, so that all the essences were immutable and each one independent from all the rest (as if for each one the others were pure non-being): this has been called Megaric 'logical atomism' and is the position held by the 'friends of ideas' of whom Plato speaks in the *Sophist* (246 b ff.).

Interpretation (B) seems to explain more effectively the doctrine, maintained by some members of the Megaric School, of the exclusive legitimacy of identical judgements, but (A) agrees more convincingly with what we know about the Megaric polemic against multiplicity and becoming.

Methodologically speaking, Euclid held that one should attack not one's opponents' premisses, but rather their conclusions. Amongst the Megaric arguments against multiplicity (and against the validity of the empirical experience in its favour) the 'sorites' (from *soros*, i.e. pile) and the argument of the 'bald person' were especially well known. The essence of these arguments is, it seems, the following: if multiplicity existed, it would be characterized by the quantitatives 'more' and 'less', which are manifestly (both empirically and logically) indeterminable and hence lacking in substance.

Other arguments formulated by Euclid (and by members of his school) are of the type known today as antinomies or paradoxes. The most famous of these is that of the 'liar', to which Cicero (106–43 BC) refers (*Academica* IV, 29, 96): "if you say that you are lying, either you are telling the truth, in which case you are lying, or else you are lying, in which case you are telling the truth". The antinomy of the 'liar' is included among what F. P. Ramsey called the semantic antinomies. It can be avoided, according to Rudolf Carnap and W. V. O. Quine, if one distinguishes different levels of language, in conformity with Alfred Tarski's theory. So the assertion 'I lie' makes sense only if it is understood as an assertion that refers to the object-language, and in this case it can be true or false. Another way of avoiding the paradox, due to Saul Kripke, involves distinguishing the semantic levels of the predicate 'true'. According to this view, the liar paradox cannot get a truth value at any semantic level.

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Events

An event is anything that happens, an occurrence; something that occurs in a certain place during a particular interval of time.

It appears that, while the concept of change has a philosophical history as long as that of Western philosophy itself, and while the concept of an event seems to be inextricably bound up with that of change, the concept of an event itself seems not to have been the focus of sustained philosophical treatment until fairly recent times. Thus, while some ancient Greek philosophers wondered about the processes by which things change, they did not give much thought, if any, to the very idea of a process itself. And Aristotle, though he wondered about what made actions (presumably a species of event) intentional and certainly thought at great length about the idea of change and the various species of change, could find no room for events in his ontology, since they are neither substances nor properties of substances.

In modern times, due in part to a re-emergence of interest in the concept of change and in part to the growing use of the concept of an event in scientific writing and in theorizing about science, the idea of an event begins to take on a philosophical life of its own. J. M. E. McTaggart, A. N. Whitehead, and C. D. Broad (1887–1971) seem to have begun the modern discussion of events. And, perhaps, the most recent interest in the nature of events was sparked by U. T. Place and J. J. C. Smart, who formulated versions of the Mind–Body Identity Thesis explicitly in terms of events, by Donald Davidson, through his work on the semantics of action sentences, and by the thought that getting clear on the nature of events would facilitate discussion of other philosophical issues (e.g., causation).

Current philosophical discussion of events has centred around two fundamental questions:

(1) Are there such things as events?
(2) If so, what is the nature of these entities?

Although it might seem that the first of these questions should be settled before worrying about the second, philosophers have rightly tied the two together, since whether or not there are events depends at least in part on what events would be like if there were any.

Many philosophers simply assume that there are events; others argue explicitly for the truth of that assumption. Such arguments have been principally concerned with finding semantic theories for certain ordinary claims that apparently have to do with the fact that some agent has done something or that something has changed; and this semantic focus is correct. A metaphysically appropriate reason for thinking that there are

entities belonging to some kind or other consists of (1) a deductive argument, whose premiss is a commonsensical claim (e.g., 'Vesuvius erupted') and whose conclusion is that there are entities belonging to the kind in question, and (2) an inductive argument, an inference to the best explanation of the fact that the commonsensical premiss means what it does, where what it means is at least in part revealed by the logical relations it bears to other claims. And that best explanation, if the deductive argument is valid, will show that the premiss entails that there are entities belonging to the kind in question. It is in this way that Davidson, for example, argues that there are events, by arguing that an acceptable semantic theory for claims involving adverbial modifiers (e.g., 'Jones killed Smith in the kitchen with a gun') and for singular causal claims (e.g., 'the short circuit caused the fire') shows that they implicitly existentially quantify over killings and short circuits and fires (which are events). Opponents of Davidson's argument (e.g., Romane Clark, Terence Horgan) have argued that a better semantic theory will show Davidson's conclusions to be unwarranted.

Though this is a controversial matter, many philosophers presume that the events whose existence is proved by such arguments are particular occurrences. That is, events are non-repeatable happenings; and they have spatial location. It is typical of philosophers who think this way to associate in some way (however inexplicitly) the concept of an event with the concept of *change*; an event is a change in some object or other. Thus, the time at which an event occurs can be associated with the time at which the object, which is the subject of that event, changes from the having of one to the having of another, contrary property. If the idea of an event is the idea of an object's changing, then, since no object can have both a property and one of its contraries at the same time, there can be no instantaneous events, and every event occurs at some interval of time. (A time *during* which an event occurs is any period of time that includes every instant of time at which it is occurring, and it occurs *at* the shortest such interval.) Events get their spatial locations by virtue of being changes in things that themselves have spatial locations. Thus, an event that is a change in an object, x, from being F to being G, is located wherever x is at the time it changes from being F to being G. Since, if x is located at place p it is also located in any place that includes p, events have no unique spatial locations. But, just as it is appropriate to say that the spatial location of a changing thing is the smallest region of space that encloses it, it is appropriate to say that the spatial location of an event is the location of the smallest object a change in which is that event. It also seems clear that events do not have their spatial locations by dint of occupying them; if they did, just the way physical objects apparently do, then distinct events could not occur in the same place simultaneously (just as distinct physical objects cannot occupy the same place at the same time). But it does seem that more than one event can occur at the same time and place. However, some philosophers (e.g., W. V. O. Quine) accept the idea that events are just as concrete as physical objects are, and go on to propose that events and physical objects are not to be thought of as belonging to distinct metaphysical kinds.

It seems evident that some events are events of which another event is composed (e.g. the sinking of a ship seems composed of the sinkings of its parts), in much the way that at least some physical objects are composed of parts. However, it also seems evident that not every group of events are events of which another is composed; there just is no event composed of the first eruption of Vesuvius and Nixon's resigning in 1974. What is not evident is what the principles, if any, are that determine when events compose more complex events.

Some views of events are compatible with there being subjectless events, events that are not the changes in anything whatsoever. Perhaps Whitehead's is such a view of events. Whether such a view is a possible one is an unsettled issue. What seems clear, however, is that if there were subjectless events, they could not be changes; for it seems absurd to suppose that there could be a change that was not a change in or of anything whatsoever. And it is not clear what to make of a concept of events that was detached from that of change.

Any serious theory about the nature of entities belonging to some metaphysically interesting kind must address the issue of what properties, if any, such entities have essentially. In the case of events, the issue is made more pressing, for example, by the fact that certain current theories (e.g., David Lewis's) concerning event causation require that reasoned judgements be made with regard to whether certain events would occur under certain, counterfactual circumstances. To deal with such issues, the essential features of events must be determined. In the recent literature on events, attention has been given to three proposals. The first is that it is essential to each event that it be a change in the entity it is in fact a change in. The second is that it is essential to each event that it occur at the time at which it in fact occurs. And the third is that it is essential that each event be a change with respect to the same properties it is in fact a change with respect to. Though the first two have received some attention, the issue attracting by far the most has been the third. This has been due to the prominence given to debates on that issue between Jaegwon Kim and Donald Davidson.

Once the question of the existence of events is settled (either by argument or assumption) in the affirmative, philosophers then turn to the construction of theories about events. Usually, the construction centres on the articulation of a 'criterion of identity' for events, a principle giving conditions necessary and sufficient for an event e and an event e' to be one and the same event. Such a principle, it appears, is sought because, when it satisfies certain constraints, it is a vehicle for articulating a view about what it is to be an event and how events are related to objects belonging to other kinds. Current in the literature are several general types of theory about events, all of which have their supporters and their opponents.

Roderick M. Chisholm's theory is motivated by the fact that it seems to be the case that some of what we say implies that events can literally recur (e.g., 'there was an earthquake in Los Angeles yesterday, and the same thing happened today'). Given that idea and the apparently similar phenomenon that two people can have the same desire (or that one person may believe what another person fears), Chisholm proposes that events, along with propositions, be understood as a species of states of affairs, *abstract* entities that can serve as the objects of the 'propositional attitudes'. Events, thus construed as abstract, literally have no spatial or temporal location; however, Chisholm attempts to show how we can nevertheless understand claims that apparently attribute such features to events. And events can be said to be identical if and only if they are objects of all the same propositional attitudes. (Events, construed as particular occurrences, cannot recur. For such an event to recur is for there to be distinct times at which that event occurs. But no such event occurs at or during any period of time that does not include all the times at which it is occurring. Thus, for such an event to recur it must occur at a time that does not include a time, namely the time of its alleged recurrence, during which it is occurring.)

Quine holds that physical objects, like events, have temporal parts, and that events may be identified with the temporal parts of physical objects, and are thus concrete particulars. Events and physical objects would thus share the same condition of identity: sameness of spatio-temporal location. (Whitehead at one time expressed the view that events are the most fundamental particulars and that they are more basic than physical objects in that the latter are constructions out of events. Variations on this idea seem to be found in more contemporary writers, such as Quine. Such a view, however, it would appear, could not be correct, if it were the case that the very idea of an event is the idea of a change in some physical object.)

Myles Brand, unlike Chisholm but like Quine and others, is impressed by the particularity of events, by the fact that events are much like physical objects in literally having spatial and temporal features; but he disagrees with Quine, in that he is convinced that, unlike physical objects, more than one event can occupy the same spatio-temporal location. Thus, Brand thinks that the criterion of identity for events should resemble (but not replicate) the usual criterion of identity

for physical objects; events are identical if and only if they necessarily have the same spatio-temporal location. So, events e and e' might be distinct even though they in fact occur at the same time and place, for it might be the case that they have different such locations or that one occurs and the other does not.

Kim is interested in events in so far as such things figure as the objects of empirical explanations. Since what is typically explained is an object's having of a property at a certain time, Kim takes an event to be the exemplification of a property (or relation) by an object (or objects) at a time; and event e is the same as an event e' if and only if e and e' are the exemplifications of the same property by the same object(s) at the same time.

Davidson has been interested in finding a 'co-ordinate system' in which to 'locate' events, in the way that spatio-temporal co-ordinates specify the locations of physical objects; Davidson has proposed that the network of causes and effects provides such a framework and that events, being essentially the things that cause and are caused, are identical just in case they occupy the same place in that framework, that is, just in case they have the same causes and effects. More recently, however, Davidson seems to have abandoned this position in favour of Quine's.

Another view (Lawrence Lombard's) has it that events ought to be thought of, primarily and fundamentally, as the (non-relational, non-Cambridge) changes that physical objects undergo when they change. Such changes are construed as 'movements' by objects from the having of one to the having of another property through densely populated quality spaces, where each quality space is a class of contrary properties the mere having of any member of which by an object does not imply change. Events can then be divided into atomic events and events composed of atomic events, where an event is atomic just in case (roughly) it is a continuous change in a single partless thing with respect to certain (atomic) quality spaces. Non-atomic events are identical just in case they are composed of the same atomic events; and atomic events are identical just in case they are simultaneous movements by the same atomic object through the same portion of the same atomic quality space.

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Existence I: History

Questions about existence are so fundamental as to seem coeval with philosophy itself. Yet the Greeks, who initiated the tradition of ontological thought, never used 'existence', a word with Latin roots and no exact Greek translation; their preoccupation was instead with what is ordinarily translated into English as 'being'. Of course 'being', according to Aristotle, is said in many ways, and whether or not there is some coincidence of one or more of these with 'existence' is something that cannot be decided by linguistic facts alone.

Ancient Philosophy: the Question of Being. It is Parmenides who first brings the question of being into the centre of philosophical inquiry. His predecessors, in their search for that which abides through change, assume that 'to be' means to be permanent, yet fail to deny that what comes to be and passes away also is. In accepting the equation of being and permanence, however, along with the premiss that only what is is thinkable, Parmenides reaches the conclusion that coming to be and passing away cannot be thought. The radical result of Parmenides's argument – and the puzzle he bequeaths to his successors – is the denial of the phenomena of nature altogether.

Plato confronts the Parmenidean problem most directly in two works in particular: he has Parmenides explore the consequences of his own hypothesis that 'Being is one' (*Parm.* 136a ff.) and the Eleatic Stranger in the

Sophist (241d–e, 257b–259c) commit 'parricide' against Parmenides by replacing the supposedly unintelligible notion of 'that which is not simply' by 'that which is other', thus making it possible to admit the being of falsehood, image, and appearance, along with difference of kinds. In contrast with the pre-Socratics, however, Plato extracts the theoretical problem from a specifically human phenomenon: the experience which arouses our wonder about non-being, as the *Phaedo* demonstrates, is death. For us, accordingly, the paradigm of what it is to be is to be alive. To be alive, however, is to be changing, whereas to be, granting the premiss exposed by Parmenides, is to be beyond all change. This paradox is manifest in the 'theology' of the *Republic*, where Socrates lays down norms for the representation of the highest beings as immutable and the cause only of good: the poets' images of living gods, he implies, are to be replaced by statue-like 'ideas'.

In the *Metaphysics*, Aristotle too offers a theology, although it seems to stand in tension with his stated aim of pursuing a comprehensive account of being as such. In order to thwart the threat that the equivocity of 'being' poses to the unity of that account, Aristotle searches for a primary meaning of 'being' from which all other senses can be derived. 'Substance', however, proposed as that unifying semantic core, proves to be equivocal as well. It is form as actuality which receives the strongest defence; but in so far as that core sense of 'substance' can be fully satisfied only by a particular kind of thing, God, only the highest being can be said in the precise sense to be. Further, if this living being, whose life is defined as the pure actuality of 'thought thinking itself', were the paradigm of what it is to be alive, everything else would have to be said, strictly speaking, to be dead, or not at all. Thus, either 'being' has a comprehensive sense that holds of everything, but only by suffering a loss of discriminatory power, or it functions as a term of distinction, but by dispersing into a variety of particular senses only one of which holds strictly. 'Being', Aristotle admits, is a perplexity not only of old and now but always.

Medieval Philosophy: Existence and Essence. That 'existence' also exhibits such a tension between a single comprehensive meaning and a plurality of precise ones is suggested by its contrastive relation to essence. Not every conceivable essence is realized in an existent entity: 'existence' univocally means instantiated essence. As Thomas Aquinas maintains, 'existence' (*esse*) stands to essence as actuality to potentiality (*Sum. Theol.* I, q.3, art.4). Yet the ontological argument for the existence of God, constructed by Anselm of Canterbury, among others, renders 'existence' equivocal, for as one of a set of properties constitutive of God's essence, 'existence' must mean necessarily rather than simply instantiated essence. Aquinas's discussion of the existence of God leads by a different path to the same difficulty: since such a being exists but admits of no potentiality, there is no basis for the contrastive relation between essence and existence which otherwise fixes the distinct meanings of those terms. Hence 'existence' in this case must have a unique sense.

Modern Philosophy: Existence and Reality, Logic of Existence, Existentialism. René Descartes, in the *Meditations*, helps initiate modern philosophy by casting the issue of existence in what is primarily an epistemological light. The internalization of essence in the form of ideas as mental contents leads to systematic doubt about their instantiation in the external world. This implies that to exist is to be mind-independent. But either that leads to paradoxical consequences for the existence of himself as a thinking being, which Descartes holds to be beyond doubt, or 'existence' must be construed once again as an equivocal term.

Two very different issues about existence have been of interest in more recent philosophy. One of these, concerning the logical status of 'existence', has its roots in Leibniz's claim (*Nouveaux Essais* IV.1.3) that, when something is said to possess real existence, 'existence' itself is a predicate. It is Kant's rejection of that view which serves as the basis for his criticism of the ontological argument: it is fundamentally flawed because it falsely assumes that existence is one of the properties constituting the essence of God (*CPR* B618–30). With the emergence of modern logic the opportunity arises to exploit

the function of the existential quantifier in order to provide an analysis of what it means 'to exist'. Gottlob Frege concludes that 'existence' is falsely understood as a property of individuals and should rather be construed as a second-order 'property of properties'. Accordingly, that an individual or kind of thing exists means that its concept is instantiated.

Under the title of existentialism, philosophers beginning with Søren Kierkegaard (1813–55) have focused on the distinctive character of human existence. In his famous formula, "Existence precedes essence", Jean-Paul Sartre exploits the traditional distinction to assert that no human being simply instantiates a predetermined individual essence but instead takes responsibility for what he turns out to be. As a claim about being human, however, Sartre's denial of the priority of individual essence is coupled with a positing of specifically human essence, which he identifies, in *Being and Nothingness*, as the negating act of freedom. In *Being and Time*, Martin Heidegger differentiates humans as the only beings who, in their active involvements in the world, already operate with a guiding understanding of being, and who alone are concerned with their own being, hence with its limits, death. By reserving 'existence' to designate this specific mode of being that belongs to humans, Heidegger yokes the issue of existence to his wider aim of recovering the ancient question of being.

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Existence
II: Existence and Non-Existence

While the topic of existence ought to be a central concern of philosophy, the fundamental notion of ontology, the notion in fact remains remarkably underinvestigated because of certain ancient prejudices, such as referential assumptions embedded deep in mainstream philosophy. Most important among these is the ontological assumption, according to which whatever is a (logical) subject, whatever is genuinely talked about, exists. (The assumption appears in various different guises, e.g. as narrowed to what is *truly* talked about, and also in derived forms, e.g. as restricted to quantifiable talk, a form sloganized as 'to exist is to admit of construal as a value of a bound variable' and the like.) Accordingly, then, discourse that is apparently about what does not exist must be reduced, in one way or another, to proper (logical) form, namely that conforming to the above assumption.

The mainstream result is a grand (but misguided) reduction programme for many types of problematic language, especially that about fictions, i.e. fictional items generally, and that about universals, abstractions, and theoretical items. The so-called 'riddle of existence' (or 'Plato's beard') derives from the same assumption. The puzzle is: how is it possible to make true statements, such as 'Pegasus does not exist', about the non-existent, since the statement yields both that the subject (Pegasus in the example) exists, by the assumption, and that it does not, because that statement is true? The received resolution involves both an analysis, or removal of 'Pegasus' from the class of genuine names and logical subjects, and circumscription of the 'predicate' 'exists' (and of course its associated negation) under the dogma that existence is not a predicate.

Under the alternative object-theory approach, still a minor philosophical stream but one systematizing much traditional philosophical and everyday practice, all this analytic and reductive activity is avoided. For example, 'Pegasus does not exist' is admitted to be what it appears to be, a grammatically satisfactory subject-predicate statement, without existential commitment; it is a statement about (or signifying) a non-existent object, Pegasus, and ascribing to it the property of non-existence. So existence, too, is a predicate, indeed a rather distinguished one, of which it would be reasonable to expect

some suitable philosophical characterization. Neither it nor non-existence is especially puzzling, or beyond characterization and therefore discussion; nor is it without criteria because it is not a feature of everything nor is it distributed everywhere.

As one of the most important notions in all philosophy, it would be reasonable to expect a range of competing characterizations of existence and criteria for it. That such an expectation is far from fulfilled can be attributed to the pervasive mainstream proposition that everything exists, a corollary of the ontological assumption. Hence, as there is no contrast, there is no serious need for any characterization. Under the referential mainstream, philosophical problems concerning existence become primarily those of how to deal with apparent infringement of the evident answer to the ontological question 'What exists?'; namely, every thing. The issues are transformed into accounting for those 'things' we regularly talk and think about which do not exist: fictions, which enter into much conversation and reflection, although they do not in fact exist; universals and other abstractions, which appear inevitable in scientific theorizing, even though they appear never to exist; and past and future objects, which do not now exist. Thus conventional discussions of existence, which are quickly broken down under a few headings: fictions, universals, purely past and future objects (e.g. Prior, "Existence", in P. Edwards, ed., *Encyclopedia of Philosophy*).

As regards universals, and similarly for other (logical) abstractions, there is an endless and sterile debate between three stock positions, all of which have many variants: realism (where some universals, e.g. those required by science, enjoy irreducible existence either on their own or within or through other existents), conceptualism or idealism (reduction to concepts or ideas), and nominalism (reduction to symbols, with no existence otherwise). But the stock merry-go-round revolves upon shared referential assumptions, critically the ontological assumption applied to universals, that unreduced talk about them requires their existence. With these assumptions removed the way is clear for unfettered theorizing with and about universals and existentially unconstrained investigation of their features. Investigation of what they are like, their characterization, can now come first; consideration of whether any exist later. Once this approach is taken, there is an easy route to the conclusion that none of them exists, because they one and all lack the right features to do so. That does not exclude some of them, for instance those that figure prominently in science, from important theoretical and explanatory roles.

The assumption-undermining object-theory alternative does not carry any commitment to traditional doctrines concerning essence, long entangled (in priority and other disputes) with questions of existence. For characterization is a wider, less loaded notion than essence. Characterizations may be fuzzy, not tied to necessary and sufficient conditions but to looser specifications; they themselves are further non-existent items. Nor do they 'precede' existence, though elements of them are needed in order to ascertain whether something exists or not.

As regards fictions, none but the mentally deranged and philosophers entrapped in hopeless theories wish to ascribe existence to them – for good reasons, the right features and relations do not obtain. (Real-life figures who occur in fiction or fictional biography are a separable issue from pure fictions.) So the main orthodox issue, forced again by referential assumptions, is: how to analyse (away) discourse concerning fictions, given that it undoubtedly occurs? In response to this demand, the orthodox philosophical literature supplies a range of competing inadequate theories. The theory of fictions of Jeremy Bentham (1748–1832) and Bertrand Russell's theory of descriptions are among the first and most famous of these eliminative exercises. These days the theories are mostly partly formalized, equipped with description or abstraction operators and technical reductive schemes, applying these for analysing statements purportedly about what does not exist into statements purportedly about what does exist. But for those who have seen through the presupposed referential assumptions this literature too is merely a sideshow, like the markets in competing religions or quack medicines. The problems concerning

fictions, such as they are, are primarily problems in explaining what different fictional objects are like, what logics they conform to, and so forth; they are not problems concerning existence.

With past and future items, traditional referential difficulties with time and change have been exacerbated by (special) relativity theory, which appears to render the present, and therewith present existence, relative to a chosen inertial frame. For those who assume that existence is an absolute (a declining group even among hardline referentialists, as ontological relativity climbs in fashionability), or at least an invariant, this increases pressures to insist that all temporal items always exist. However, from outside the referential mind-set, what can be seen to happen is this: there is a new insistence on a shift from existence – after all, existence ordinarily is existence now, present existence – to a derivative notion of sometime-existence. But sometime-existents such as Hegel and a unified Europe (assuming it comes to pass), though they have existed or will exist, do not exist, i.e. exist now in the standard terrestrial time-frame. Escaping from the referential assumption-set also enables a straightforward dissolution of other hoary philosophical puzzles concerning time and change and existence; for example, as to how something can come into existence or pass out of existence, and so as to how something can change (as e.g. what it was ceases to exist). Thus, for instance, coming into existence is not accurately represented in the puzzling form of something coming from nothing at all (whence the conventional wisdom, *ex nihilo nihil fit*), but as a transition of something from something else which does not exist; the transiting item acquires the property of existence rather as the freshly rubberized surface acquires the property of resistance.

Although defining existence is a controversial affair, the notion is not entirely uncontrolled; there are fairly uncontroversial bounds. It is generally taken that such material things as sticks and stones, which can hurt, do exist, but that mere names, as distinct from sounds and marks on surfaces, do not; nor do impossible objects or the characters of pure fiction or imagination or speculation. But in between are extensive controversial areas. As policy in arriving at an account of existence we could do worse than to heed Ockham's razor, not to multiply what exists beyond necessity, which translates into: begin with those items which obviously exist, not-controversially, such as medium-size material objects, and close under enlargements produced by unavoidable extensions thereof, such as compounding or summation and dissection or analysis. But exclude unnecessary items, such as illusions, imaginary items, dream characters, and unnecessary operations, such as abstraction, idealization, fictional variation, and so forth. The route to an appropriately minimalist definition of existence is now evident. An item exists if it stands in suitable physical relations to the paradigm existents. (Such a definition is refined and synthesized with other accounts of existence in Routley 1980, Chapter 9.)

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RICHARD SYLVAN

Experience

Experience has long been important for philosophers under a variety of terms: 'phenomena' for Plato and Aristotle; 'presentations' for the Stoics; 'phantasms' for the scholastics; 'ideas' for John Locke, under the influence of René Descartes, and for George Berkeley, under the influence of Locke; 'impressions' for David Hume; and 'intuitions' or 'representations' for Kant; among many others. In the early decades of contemporary analytic philosophy it took centre stage in the form of such issues as verificationism, phenomenalism, and the theory of sense-data or (in the usage I shall prefer) sensa. It is the last of these that addresses the main question to be posed

here, that of the ontological nature of experience, of its ontological analysis or status.

Let us think of events as entities ontologically derivative from more basic properties, relations, and particulars, by conceiving of them as either supervenient upon or identical with ordered $(n+1)$-tuples constituted by an n-ary property or relation and a sequence of particulars of length n. Events are hence conceived to include also states and processes. And we may now think of an event as n-adic or as being of degree n if its corresponding structure is an $(n+1)$-tuple.

Thinking of particular sensory experiences (experiencings) that particular subjects undergo at specific times as events in this broad sense, what is the degree of such events? Do they vary in degree or are they all fundamentally of the same degree? Here the main division has divided (a) those who think of experience as monadic, on the model of a cheerleader's kick (or, better, on that of a reflex kick, one due to the doctor's mallet, experience being largely involuntary); from (b) those who think of experience as dyadic, on the model of a football kick, or polyadic, on the model of a juggler's juggling.

Reflection aimed at choosing between the two sides of this main divide has yielded questions like the following for the dyadist (polyadist) analysis:

1. If sensa are ontologically private, as they seem to be, it being essential to headaches, for instance, that they belong to their actual victims, and if this is a peculiarity of sensa not shared by one's possessions or belongings generally, what explains so remarkable a peculiarity?
2. Do sensa have surfaces? Backsides?
3. Are sensa fully determinate? Does a polka-dot sensum have a specific number of dots? Can it be 3.758 times longer than it is wide?
4. Are sensa, e.g., visual sensa, ever identical with surfaces?
5. Can sensa ever appear other than they really are? Or is it their essential function exactly to close permanently the appearance–reality gap?

Years of such probing questions have left little life in sensa. Adverbialist theories – one sort of monadist analysis of experience – now hold the field. (For early statements, see C. J. Ducasse, "Moore's refutation of idealism", in P. A. Schilpp, ed., *The Philosophy of G. E. Moore*; and R. M. Chisholm, *Perceiving*.) But one main question looms large for any such monadist analysis: What is the status in experience of the properties that do seem *somehow* present in it? What is the status in visual experience, for instance, of the colour properties that seem somehow present in it? When one hallucinates a snowball, whiteness and roundness seem somehow present in or relevant to one's experience. In what way are they thus present or relevant? Certainly one's sensing or imaging are not white or round, nor does one's person have the whiteness or roundness of a snowball. How then are whiteness and roundness present when one hallucinates a snowball? For the theory of sensa the answer is simple. It is one's sensum (sensory image) that is then white and round; it is indeed such an image that is most fundamentally and literally white and round. With the demise of sensa, sensory properties are bereft of any proper owner in our experience. But any acceptable analysis of experience is required to find them a place. What place then have they on a monadist view?

Compare being a map of an island with hills, brooks, and trees, or being a picture of such an island, or being a description of such an island, with being a dream or a hallucination, or any visual experience of such an island. A description of such an island may, of course, consist of no hills, brooks, or trees, but only of certain sounds or shapes on paper. Accordingly, to say that one has a visual experience (a sight) of a red triangular patch may be conceived of as a way of classifying one's experience as being of a certain sort, the of-a-red-triangular-patch sort. And just as a description of an island with certain features (in a story) does not require that there ever be a real island with those features, so a visual experience of a patch with certain features need not require the existence of any real patch with those features.

An objection to monadism has been pressed by latter-day friends of sensa, the

so-called 'many-properties problem'. Very briefly, the problem is how to think of the experience of someone with a visual experience of a red circle to the left of a blue square. This is urged as an objection to that form of monadism known as the adverbial theory, which replaces 'S senses a red sensum' with 'S senses redly'. This objection may underestimate the versatility of the adverbial theory, which does not strap itself with a restriction to simple predicates and seems able to distinguish between experience of a red circle to the left of a blue square and experience of a blue circle to the left of a red square by use of the predicates senses-red-circle-to-the-left-of-a-blue-square and senses-blue-circle-to-the-left-of-a-red-square. Yet the objection does have the merit of forcing the following question: does not the adverbial technique lend itself to abuse by allowing too easy a reduction of all ontological commitment to some Reality, or Absolute, or Natura, or the like? Without regard to the degree of complexity of any claim *p* that one might affirm, it would be possible to reduce it to a claim that Reality realizes (or is real) *p*-ly. One would indeed be tempted to go a step further by interpreting any claim that such-and-such as the claim that it such-and-such's on the model of 'It rains'. Here the technique is to 'verbalize', as when one verbalizes rain by replacing 'Rain falls' by 'It rains'. And it is not obvious just where or how to draw the line between use and abuse of such adverbalization or verbalization.

For those who already have some use for propositions or possible states of affairs, there is in any case an alternative conception of experience, one that regards experience as a sort of propositional attitude with a variety of modes: visual, auditory, and so on. Thus *S* might have a visual experience of (there being) something white and round before him, or in an alternative description he might visually experience as if there were something white and round before him.

For any given mode of sensing there appear to be certain special properties proper to that mode of sensing in that any other properties sensed by that mode of sensing would be sensed somehow by sensing the ones proper to it. Accordingly, we can conceive of purely vision-phenomenal propositions (for example) as those constituted by no properties or relations except those proper to vision. Vision-phenomenal propositions would then typically specify the colours and shapes of the facing surfaces of things before one at the time, as well as the visually basic relations among them.

This propositional conception of sensory experience provides answers for two questions raised earlier for the monadist. If there are no sensa to have the properties that seem somehow present in visual experience, such as colour and shape, what place can we then find for such properties? For the propositional view such properties have a place as constituents of the phenomenal propositions visually experienced, as when one has a visual experience of (there being) something white and round before one.

As for the difference between the red circle to the left of a blue square and the blue circle to the left of a red square, since the proposition that there is a red circle to the left of a blue square before one is distinct from the proposition that there is a blue circle to the left of a red square before one, it follows that visual experience of the one proposition may be distinguished from visual experience of the other.

When a subject has a visual experience of there being something white and round before him, must the propositional relation in question supervene on monadic, intrinsic properties of the subject and of the phenomenal proposition? If so, then the adverbial monadist theory would seem fundamentally right. For the monadic, intrinsic property of the phenomenal proposition would surely be a necessary property of it, so that ultimately S's experiencing as if there were something white and round before him would derive necessarily from his having some monadic, intrinsic property. What monadic intrinsic property? Whatever such property underlies on his side the supervenient relation of visual experiencing that he bears to the phenomenal proposition involved.

But if one insists that the propositional relation of sensory experiencing must supervene in the way suggested on monadic, intrinsic properties of subjects, then one would

seem to be committed to a similar view about propositional relations generally, including propositional attitudes. At a minimum one would need to argue for some mark of visual experience that distinguishes it as a necessarily supervenient relation from other propositional relations such as propositional attitudes.

Whether a propositional relation of visual experience turns out to be be fundamental or supervenient, a propositional view of sensory experience may be illuminating in any case. For even if (if!) at a fundamental level there is no experience and there are no propositions, there is still interest enough in questions about the nature and intentionality of experience, if only as questions about a Phenomenal World or Common Sense or Manifest Image which may seem either reducible and derivative or just plain false. After all, rejection is worth no more than the understanding that gives it content.

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ERNEST SOSA

Explanation

The contemporary study of scientific explanation begins with the seminal work of C. G. Hempel and P. Oppenheim (1948). While earlier writers (for example, Karl Popper) had recognized the importance of explanation as a mode of scientific activity, most logical empiricists concentrated on explicating the predictive power of scientific hypotheses and theories and on understanding the confirmation relation. Hempel and Oppenheim set themselves a double goal: first, to present an informal analysis of the conditions that a scientific explanation must meet; second, to translate these conditions into a formal account of the explanatory power of theories. While their formal explication foundered on certain technical difficulties, their informal analysis dominated the discussion of scientific explanation for roughly a quarter of a century.

Hempel and Oppenheim proposed that explanations are arguments in which a description of the event to be explained (the *explanandum*) is derived from premisses (the *explanans*) among which is a general law of nature. They acknowledged that there are cases of probabilistic and statistical explanation in which the explaining argument is inductive in character and that, in some instances, the conclusions of explanatory arguments (the *explananda*) are generalizations about natural regularities rather than singular sentences describing particular facts and events. However, they concentrated their attention on the apparently most tractable examples, those of deductive explanation of singular sentences.

The *deductive-nomological* model was extended in Hempel's subsequent work, particularly in Hempel (1965), where an account of deductive explanation of statistical generalizations and an *inductive-statistical* model of the explanation of individual events was added. Just as singular explananda are sometimes explained by deriving them from premisses that contain a law, so too, Hempel proposed, we can sometimes frame explanatory arguments that are inductive and that show that the event described in the explanandum had high probability of occurring. Thus, in one of the famous paradigms, we might explain the recovery of a person suffering from a bacterial infection by using the premiss that the patient was treated with an antibiotic together with the statistical law that 99 per cent of infected people recover when treated with that antibiotic, concluding that with high probability (99 per cent) the patient recovered.

Hempel's models of explanation share the common feature that explanation involves showing that the event (fact, regularity) described in the explanandum was to be expected as a consequence of underlying laws of nature. But, as Hempel made plain in his treatment of the topic, probabilistic explanation involves complications not found

in the deductive case. Adding further premisses to a valid deductive argument does not affect the cogency of the reasoning. For inductively strong arguments, however, adding more information can subvert the reasoning: if we learn that the patient of the last paragraph is infected with a strain of bacteria that is resistant to the antibiotic, then the probability of recovery plummets. Hempel attempted to circumvent this difficulty by adding a further requirement, the requirement of *maximal specificity*.

For all the clarity and care with which it has been articulated, the Hempelian approach to explanation faces apparently insuperable difficulties. The concept of a law of nature has proved remarkably recalcitrant to explication. Moreover, there seem to be many instances in which derivation from a set of premisses involving a law is non-explanatory. One class of examples consists of the *asymmetries* of explanation, a paradigm of which is Sylvain Bromberger's case of the flag-pole: we can apparently explain the length of a shadow cast by a flag-pole by deriving the shadow length from the elevation of the sun, the flagpole height and the laws of propagation of light; equally we can derive the flag-pole height from the shadow length, the elevation and the propagation laws, but the latter derivation is non-explanatory. What accounts for the difference?

Perhaps the chief source of problems for Hempel's model was the area of statistical explanation, an area that generated the first main rival. Wesley Salmon (1970) proposed that explanation consists in the assembly of *statistically relevant information*. When we explain an event or state, we adduce background conditions that raise the probability that the event or state occurred: thus we explain recovery by noting that a person has been treated with an antibiotic if the probability of recovery given the treatment is greater than the prior probability of recovery. So simple a proposal will not quite work, as Salmon appreciated, for we must beware of epiphenomenal correlations. The barometer's falling raises the probability that a storm is in the offing, but does not explain the coming storm. Here, the barometer indicates an underlying condition that is not only statistically but also explanatorily relevant. The programme for the statistical relevance approach to explanation was to formulate probabilistic conditions, articulating the central intuition while avoiding problems posed by mere correlations.

Continued attempts to carry out this programme met with little success, and, in the past decade, Salmon and other writers (Paul Humphreys, Nancy Cartwright, and Peter Railton) have made explicit use of causal concepts in providing analyses of scientific explanation. According to this influential approach, scientific explanation consists in identifying the underlying mechanisms that produce events, states, and general regularities. Consideration of the asymmetries of explanation provides a clear motivation for the approach. A natural response to the puzzle of Bromberger's flagpole is to declare that the flag-pole is a causal factor in the production of the shadow but not conversely. Similarly, the insights of the statistical-relevance account can be taken over by noting that background causal factors are frequently statistically relevant.

From the standpoint of logical empiricism, a simple invocation of causation would be taboo. David Hume's celebrated discussion of causation casts a long shadow over 20th-century philosophy of science, and part of the attractiveness of Hempel's covering-law approach to explanation is that it not only avoids explicit reference to causal notions but also provides a way of seeing judgements of causal dependence as derivative from judgements of explanatory dependence. Those who incline to the view that explanation involves the tracing of causes (or the identification of mechanisms) must either respond to Hume's worries about causation or else argue that such worries are unfounded. In an important book (1984), Wesley Salmon pursues the first strategy, offering a detailed theory of causation.

One long-standing difficulty, shared by Hempel's original account and the later causal approaches, is faced when one tries to analyse theoretical explanation in science. Scientific theories sometimes seem to deepen our understanding of regularities in nature: thus, to cite two classic examples, Newtonian

mechanics explains Galileo's law of free fall and Kepler's laws of planetary motion, and the kinetic theory of gases explains the laws of phenomenological thermodynamics. But, quite evidently, we cannot suppose that deriving a law from premisses that include at least one law of nature is sufficient for explanation, for that would permit the derivation of any law from the conjunction of that law with other laws. Hempel recognized the difficulty and explicitly set aside the project of analysing theoretical explanation. Equally, it seems that causal approaches to explanation must introduce new conditions for coping with the explanation of general laws.

One minority approach to explanation, begun by Michael Friedman in an important essay (1974), starts by taking the problem of theoretical explanation as central. On Friedman's account, scientific explanation is global rather than local: generalizations are embedded in theoretical systems whose function is to unify the phenomena. Working out the conception of explanation as unification is not easy, but this approach does hold the promise of addressing a recalcitrant problem while preserving the empiricist ideal of avoiding references to causation.

A second minority tradition, found in the writings of Peter Achinstein and Bas van Fraassen, takes up another neglected aspect of Hempel's programme. It was evident, almost from the beginning, that full-dress deductive arguments are rarely forthcoming on the occasions when people make requests for explanation. Thus, for Hempel and for his successors, the ideal explanatory answers were seen as adjusted in practice to the needs of the audience. The task of understanding the adjustment falls to the pragmatics of explanation. But, once a pragmatics of explanation has been articulated, it is possible to suggest that it solves all the problems of the theory of explanation: the theory of the pragmatics of explanation is portrayed as a pragmatic theory of explanation (see, for example, van Fraassen 1980, Chapter 5). The difficulty for any such theory is to place conditions on adequate explanation that will avoid the trivial result that anything can explain anything.

Contemporary theories of explanation thus fall into three main categories: causal approaches, unification approaches, and pragmatic approaches. Each approach faces different difficulties, each has its own partial successes, each has affinities with Hempel's pioneering work. Whether any of them can be developed to become completely satisfactory still remains uncertain.

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PHILIP KITCHER

Extensionalism

Extensionalism is an approach to philosophy of logic that emphasizes external, typically causal and publicly observable features of existent objects in semantic theory, establishing property identity conditions on the basis of set membership relations.

The term 'extensionalism' derives from the Fregean objectual semantics of quantificational logic espoused by Bertrand Russell, Rudolf Carnap, and W. V. O. Quine. The extension of a predicate is the set or aggregate of objects that have the property represented by the predicate. The proposition 'All swans are white' is true just in case there are no existent objects in the extension of the predicate 'swan' that are not also in the extension of the predicate 'white'. Extensionalist logic excludes reference to non-existent objects, and conflates the ontological with the semantic domain. The philosophical

implications of extensionalism are explicit in Russell's theory of definite descriptions and Quine's 'flight from intension' (1960, 191–232).

For Russell, 'The present King of France is bald' implies, among other things, that there exists a present king of France. The sentence is false by virtue of the fact that no (existent) present king of France belongs to the extension of the predicate 'present King of France'. The power and simplicity of Russell's theory of definite descriptions for the limited range of cases to which it applies has historically played a central role in the rise of extensionalist analytic philosophy.

Quine's criterion of ontological commitment, and his dispute with intensional logic and intentional psychology and semantics, places him squarely in the extensionalist tradition inaugurated by Gottlob Frege's predicate semantics and Russell's theory of descriptions. According to Quine's extensional criterion, a theory is ontically committed to whatever entities must be supposed to exist in order for its existentially quantified theses to be true. Quine distinguishes extensional from intensional linguistic contexts on the basis of the failure of intensional contexts to support intersubstitution of codesignative terms *salva veritate*, and their failure to permit quantifying-in. By these tests, Quine identifies propositional attitude, quotation, and modal contexts as intensional, and recommends eliminating them from logic and philosophy as 'creatures of darkness'. To cite just one of his famous examples: it does not follow by uniform substitution of the extensionally codesignative terms '9' and 'the number of major planets' in the modal context 'Necessarily, $9 > 5$', that therefore 'Necessarily, the number of major planets > 5'. This moves Quine to banish (especially quantified) modal logic from the legitimate domain of formal logic.

The non-extensional nature of propositional attitudes links extensionalist semantics and philosophy of logic and language with materialist-physicalist, anti-intentionalist philosophy of mind. Extensionalists sometimes derogate semantics in favour of an inscriptional theory of pure syntax and mechanical algorithms for symbol manipulation. The position is most trenchantly voiced by Russell in his "Introduction" to Wittgenstein's *Tractatus Logico-Philosophicus*, when he remarks that "a perfect notation would be a substitute for thought". In light of these challenges, it is important to recall that Frege, though a precursor of later extensionalism in Russell and Quine, regards intension as prior to extension, maintaining that the extension of a term is determined by its meaning or sense.

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DALE JACQUETTE

F

Fact

Facts have been described as the sort of things that are expressed by sentences (Bertrand Russell) or that are the case (Ludwig Wittgenstein). Neither description was intended as a definition, but only as an indication of the sort of objects in question. Wittgenstein's is perhaps preferable, in as much as it avoids recourse to language. Russell did not mean that every sentence expresses a fact, but only that true ones do.

One sometimes encounters the wider notion of a state of affairs. Facts are existent states of affairs, but there are also thought to be non-existent ones that are expressed by false sentences. On some accounts, even contradictory sentences express states of affairs, which are of course necessarily non-existent. Russell denied that there are such things as non-existent states of affairs, for much the same reasons as he urged against Alexius Meinong's non-existent objects.

The tendency to think of facts in relation to sentences has generated much discussion of such questions as whether there are negative facts as well as positive ones, general as well as particular, etc. There are well-known trade-offs here. To take just one example, it has been maintained that there is no need to posit the negative fact that the earth is not flat, given the positive fact that it is round and the relation of incompatibility that holds between its being round and its being flat. But, as Russell pointed out, we avoid positing negative facts in this way only at the cost of positing non-existent states of affairs, since at least one of the two terms of the relation of incompatibility must be non-existent.

Facts were rarely put forward as entities in their own right until the 19th century. There is a reason for this. As long as the substance-attribute metaphysics held sway there was neither need nor room for facts. For the world was regarded as divisible without residue into substances; as a totality of things, not facts. Attributes were seen as inhering in substances. Now if the whiteness of this page is something that inheres in it, the fact that it is white is superfluous. Any theoretical work it might be supposed to do is already done by the page itself. This applies in particular to the task of defining truth. For everything necessary for assessing the truth of the sentence 'the page is white' is present in the page. This is why the earliest versions of the correspondence theory were in terms of things, not facts.

What changed all this was the new appreciation of relations in the 19th century. Relations had been made to fit the substance-attribute scheme only by rather Procrustean measures. A relation was viewed as an attribute whose presence in a substance depended more on the vicissitudes of some other substance, as when something becomes smaller than something else not because of any change in its own size but because the other thing has grown. This led Thomas Aquinas to distinguish two aspects of a relation: its existence in a subject, or *inesse*, which it shares with every other attribute; and its reference to another thing, or *ad aliquid*, which is the peculiar mark of a relation. Such relations would today be called relational properties. The modern conception of a relation as holding *between* two or more things was regarded as incoherent. Leibniz, for example, said that such a relation would be an attribute with one foot in one substance and one in another, an impossibility. Once such relations are admitted, the world can no longer be divided without residue into substances. In addition to the cup and the saucer, a complete description of it must include the fact that the cup is on the saucer.

The doctrine that relations presuppose facts can be found in John Stuart Mill (1806–73) and Charles S. Peirce, both of whom employed the scholastic notion of the foundation of a relation in this connection. Since relations were traditionally regarded as having a lower degree of reality than other attributes, it was held that every relation had some non-relational entity as its foundation. Leibniz, who was a late representative of this tradition, conceived of the foundation as a non-relational property or a pair of such properties, one in each term, that serves as a sufficient condition for the truth of a relational proposition. In this way, Leibniz sought to reduce relations to non-relational attributes, a project that faces formidable, if not insuperable, difficulties. For, as Russell argued, if we make A's being larger than B consist in the possession of one size by A and another by B, we need to add that A's size is larger than B's and have thus only postponed the original problem. Mill and Peirce avoided this problem by taking as the foundation of a relation a fact involving the terms. Mill regarded this as a nominalistic reduction of relations to relational facts. Peirce, who described himself as a scholastic realist, held that relations, as warranted abstractions from such facts, qualify as existents in their own right.

Conversely, we can ask whether a fact is anything over and above the relations and terms that are presumed to be its constituents. This question was answered by another 19th-century philosopher. F. H. Bradley, the philosopher in question, is often presented as an opponent of relations, but he had no quarrel with relational facts. On the contrary, he relied constantly on the fact that everything is related to everything else. What he objected to was the reduction of such facts to their constituents. This was the point of his famous regress argument. A relation and an appropriate number of terms do not add up to a fact, as shown by the consideration that the set consisting of the cup, the saucer, and the relation of being on, which is the same as the set consisting of the saucer, the cup, and the same relation, does not distinguish the fact that the cup is on the saucer from the fact that the saucer is on the cup. The constituents must be related in the proper way. But the attempt to insure this by adding further relations between the relation and its terms only leads to a vicious regress.

Russell agreed with Bradley that facts are not reducible to relations and terms. He even employed a version of Bradley's regress argument in this connection, though without acknowledging it as such. But he still insisted that facts are composite entities and that relations are their constituents. For Bradley, the relation and its terms were an abstraction from the fact rather than its building blocks, an abstraction, moreover, that inevitably involves a certain amount of falsification. Thus the issue between Russell and Bradley was one of ontological priority, with one holding that the fact is prior and the other that its constituents are.

This may seem to be a distinction without a difference. But in part at least it is a dispute about the number of analyses a fact admits. On an atomistic view like Russell's each fact has a unique analysis into its constituents, while on a more holistic view like Bradley's there may be several equally valid analyses, since on this view the fact is prior and its constituents are abstractions from it. The definitive version of this form of holism is that of Gottlob Frege. In his early work it was applied to states of affairs, which he called 'judgeable contents' (*beurtheilbare Inhalte*), while later it was transferred to propositions or 'thoughts' (*Gedanken*).

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KENNETH R. OLSON

Family Resemblances

The doctrine of family resemblances concerns the basis for our application of general terms to particular objects. It is opposed to *semantic essentialism*, the doctrine that a general term is properly applied to objects only if all and only those objects share a common property. Semantic essentialism goes back to the dawn of recorded Western philosophy: the early dialogues of Plato. There Socrates repeatedly asks what X (usually a moral term) means, and he seems to expect answers in the form of necessary and sufficient conditions.

William Whewell (1794–1866), John Stuart Mill (1806–73), Arthur Schopenhauer (1788–1860), William James (1842–1910), and Oswald Spengler (1880–1936), among others, denied semantic essentialism in various contexts, but the most general and famous attack comes from Ludwig Wittgenstein. In his *Philosophical Investigations* Wittgenstein writes:

> Instead of pointing out something common to all . . . I am saying that these phenomena have no one thing in common on account of which we use the same word for all, – but they are *related* to one another in many different ways.

Wittgenstein asks us 'to look and see' whether there is anything common to all games:

> The result of this examination is: we see a complicated network of similarities overlapping and criss-crossing . . . I can think of no better expression to characterize these similarities than 'family resemblances'; for the various resemblances between members of a family: build, features, colour of eyes, gait, temperament, etc. etc. overlap and criss-cross in the same way (Oxford, 1953, pp. 31–2).

Thus, four games may be known to have properties *ABCD*, *BCDE*, *DEFG*, and *FGHI*. We properly call them all 'games', even though the first and the last apparently have no common properties. Family resemblance does not deny that there *might* be common properties; it denies there *must* be. Future analysis might reveal a hidden common and unique property, but the mere fact that we use the term without knowing the hidden property shows that such a property is not necessary for the term to be usable, and thereby is not part of the term's meaning.

Wittgenstein's claims are both empirical and normative. The empirical claim is that, as a matter of fact, the use of (at least some) general terms does not depend on finding one common and unique property among all the exemplars, but instead on noticing overlapping resemblances. The normative claim is that this is not a defect in language: if our words have a role then they have meaning; there should be no *a priori* (and in particular, essentialist) restraint on meaning. This is part of the general theme in the *Philosophical Investigations* that the locus of the meaning of a term is in the practice where the term is used.

That theme is in contrast with the metaphysics of the early Wittgenstein's and Bertrand Russell's *logical atomism*, according to which the analysis of propositions would reveal the ontological structure of the world, including necessarily existing objects. As semantic essentialism was one element of logical atomism, Wittgenstein's immediate goal for family resemblances in the *Philosophical Investigations* was to challenge the logical atomists' conceptions of language and the metaphysical implications of philosophical analysis.

After Wittgenstein, family resemblance has been used in fields ranging from aesthetics and law to biology and artificial intelligence.

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STEVEN GERRARD

Fichte, Johann Gottlieb

Johann Gottlieb Fichte was born in Rammenau/Lausitz in 1762 and died in Berlin in 1814. He studied theology at Jena and Leipzig where he heard the disciples of Christian August Crusius and followed contemporary discussions about freedom and determinism. Fichte became properly engaged in philosophy in 1750 when he came to know the works of Kant and was received into the Kantian circle at Königsberg. In 1794 Fichte was called to Jena as successor to Karl Leonhard Reinhold (1757–1833). Being banned from Jena in 1798–99 because of the 'dispute about atheism', he moved to Berlin, eventually becoming dean and rector of Berlin University, which had been founded in 1810. An ardent representative of German unity, Fichte exerted an influence also beyond the philosophical sphere and became, together with Schelling, Novalis, and Schlegel, one of the outstanding figures of German romanticism.

Decisive writings for his philosophical system are *On the Concept of the Theory of Science* (1794), *Foundation of the Theory of Science* (1794), and the *First and Second Introduction* (1797). The later versions of his doctrine, published posthumously, tend more and more to an idealistic theology.

The best access to Fichte's *Doctrine of Science* is to be found in the conflict between Reinhold's version of Kantian philosophy and the sagacious attacks made against it by Gottlob Ernst Schulze (1761–1833) in his *Aenesidemus* (1792). Reinhold's attempt to deduce the new philosophy as strict science from a single principle was carried on and sharpened by Fichte. The constituent *Leitmotiv* runs as follows:

(F1) Philosophy may have only one first principle. Call this *p*.

(F2) The evidence for the principle *p* should consist in its being verified by

the very fact that one thinks p (in analogy to the truth of 'You are now reading this').

(F3) Deductions from p do not consist in logical inferences but in a progressive differentiation (analogous to the transition from genus to species); here the differences are introduced by thinking itself, stimulated by oppositions and contradictions.

As the title of his main work suggests, Fichte was in possession of certain rudimentary intuitions about problems in the philosophy of science, but these so exceeded his logical knowledge and technical tools that the development of German philosophy was marked ever after by a sort of hostility to science. Thus, for example, Fichte considered the problem of how to define the *completeness* of a system and sought the solution in structures which we consider today as cyclical groups of finite order: the 'deductions' of a complete system should lead from principle p in a finite number of steps (the theorems) back to p itself (*On the Concept* §4). Then, however, Fichte entangles himself in the problem of the circularity of this foundation.

It does not occur to Fichte to compare his system with axiomatic ones like that of Euclidean geometry. He considers the possibility of systems with several independent axioms, but believed himself to have refuted this possibility, and thus to have proved indirectly the truth of (F1). Fichte's reflections seem to flow from the semantic intuition that necessary truths have to imply each other mutually. The disproportion between his intuitions and his conceptual means, however, gave rise to the obscurity and confusion of his *Doctrine of Science*, despite its occasional spots of brilliance.

For Fichte the object of philosophy is the foundation of experience. Philosophy has to provide an explanation of why the world seems to be in space and in time and why it seems to be embedded in causal relations. Because the foundation of something has to be outside that which is founded, philosophy itself has to lie outside experience. Philosophy comes in this way to be identified with metaphysics, as a search for a meta-empirical principle. Because of assumption (F1), Fichte holds that only two meta-empirical principles of explanation and therefore only two systems are imaginable: realism, which searches for a foundation in the *Ding an sich*, and idealism, which seeks to explain experience by the structure of the self.

According to (F2) realism has to be rejected, because it maintains that experience is such-and-such because the world is such-and-such and because experience is like the world. But this it does without itself having any evident access to the world. Idealism on the contrary can find an access to the self by reflecting on itself and performing what Fichte calls an action of freedom (*Tathandlung*).

The evidence of Fichte's principle "The self poses the self in the self" is understood according to (F2). What you do in thinking of this principle verifies what you have thought: if you think that you think, then your self is in your thought and this thought is in your self. This principle and the inferences which follow from it are often formulated analogously either to the identity-principle (*I am I* in analogy to $A = A$), or to the principles of contradiction and of sufficient reason. The importance of such analogies should not, however, be overestimated. In the light of (F3), the Kantian categories are 'deduced' and the difference between theoretical and practical philosophy is established. But much more important is Fichte's assimilation of the intentionality of thinking to a form of causality (*Setzung*), in such a way that the absolute self gradually takes over the role of an epistemic God: the self creates itself by thinking and thereby creates also the framework of the empirical and moral world.

Fichte's work recalls that of Kant. Some of his results, however, bring to mind also current conceptions in philosophy of science of the sort that we find, for example, in the work of Paul Feyerabend – where the theories are held (like Fichte's self) to produce the facts. Perhaps Fichte would have preferred another interpretation of his doctrine, according to which his 'Theory of Science' should express the impetus of will that aims at action. If the self poses a not-self,

preferred another interpretation of his doctrine, according to which his 'Theory of Science' should express the impetus of will that aims at action. If the self poses a not-self, then only in order to give itself an opposition and a destiny, like Don Quixote perceiving giants in windmills to cope with his vocation as knight.

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CARLOS A. DUFOUR

Fiction

Among the various 'things' of dubious ontological standing that nevertheless appear to be objects of thought, referents of names and descriptions, and possessors of properties, fictions – Sherlock Holmes, Pegasus, unicorns – are in some ways especially troubling. Properties, propositions, and numbers may be merely different kinds of entities from the concrete particulars usually considered paradigm existents. But fictions like Sherlock Holmes appear to be concrete particulars themselves and to possess most of the ordinary sorts of properties actual ones do: Holmes is a man, a detective, lives in Baker Street, etc. So the difference between him and actual particulars would seem to be one of ontological status. According to Alexius Meinong, fictions are things that do not exist, or even 'subsist', but which nevertheless somehow are.

Fictions have much in common with non-actual objects of propositional attitudes not deriving from works of fiction – non-actual objects of belief, of desire, etc. such as Vulcan, and the daughter a childless couple wishes for but never gets. But the wished-for daughter arguably possesses only intensional properties – the property of being such that the couple hopes she will be a detective, for example, not that of being a detective. ('Holmes is a detective' seems true but 'D is a detective' – where D is the wished-for daughter – does not.)

Bertrand Russell was notoriously unsympathetic to non-actual particulars, and the received opinion among analytic philosophers has long been that quantification over them is illegitimate. But it has become increasingly evident how difficult it is to do justice to the semantics of fiction, and to account for the fact that fictional statements seem often to express truths, while forbidding such quantification (Howell 1979, Routley 1980). There has recently been a revival of realist theories, theories holding that there (really) are such things as fictions, whether or not they are said to 'exist'.

Realists (about fictions) often claim intuition and common sense to be on their side, and some take ordinary fictional statements like 'Holmes is a detective' at face value (T. Parsons 1980). But 'There is no such person as Holmes' and 'There are no unicorns' also appear to express commonsense truths. Perhaps these involve a special restricted quantifier, distinct from the one whose range comprises everything (Parsons 1980). Meinongians can say that the former quantifier ranges over only *existing* things. But 'Macbeth exists' appears to express a truth when, e.g., Macbeth contrasts with the dagger that may be only a figment of his imagination. 'Holmes exists' would seem to be true when it is understood in the spirit in which 'Holmes is a detective' is true; *within the fiction* Holmes is an *existing* detective.

Taking statements like 'Holmes is a detective' at face value, as (truly) attributing the property of being a detective to the referent of 'Holmes', is awkward. It makes most fictions *incomplete*. (Holmes neither has nor fails to have a mole on his back, if the stories do not say.) And it makes some fictions *inconsistent* (a fictional elf who squares the circle). Some simply declare fictions exempt from the laws of the excluded middle and non-contradiction. Others avoid these consequences by taking such statements to be preceded implicitly by something like 'It is true-in-the-fiction that', where truth-in-the-fiction is not construed as a species of truth.

So Holmes is such that it is true-in-the-fiction that he is a detective, but he is not (literally) a detective. On some accounts fictions are *constituted* by properties like that of being a detective, while not possessing them in the ordinary manner, e.g. they are taken to be collections of such properties (Wolterstorff 1980). Properties exist necessarily and eternally, however, whereas fictions would seem to come into existence only if and when the author creates the relevant work of fiction. Also, there would seem to be distinct fictions each consisting of the same properties – the many different soldiers in an army, for instance, if the story says nothing about how they differ from one another (Howell 1979, Fine 1982).

Many fictional statements are not easily construed as elliptical for anything like 'It is true-in-the-fiction that . . .' Holmes is said to be more famous than any actual detective, smarter than Gulliver, a fictional character, Mary's favourite character, and to have been created by Conan Doyle. It is especially difficult to account for these attributions without quantifying over fictions.

Can fictions be understood in terms of possible worlds? In addition to the problem of inconsistent fictions, Saul Kripke argued in *Naming and Necessity* (1973) that no merely fictional characters are possible individuals, that of the many distinct possible individuals bearing the properties attributed to Holmes in the stories, there is no way of saying which is the referent of actual occurrences of 'Holmes'.

Some irrealists accept quantification 'over fictions' but deny that it carries ontological commitment. Others attempt to construe fictional statements as claims about the *words* or *sentences* in works of fiction rather than about fictional objects, or as having facts about words or sentences as truth conditions (Woods 1974). Still others (Walton 1990) explain away apparent references to fictions as mere pretence or make-believe, or as indications of such.

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KENDALL L. WALTON

First Philosophy

First Philosophy in Aristotle. In *Metaphysics* VI, 1 Aristotle distinguishes three theoretical 'philosophies': mathematics, physics, and theology, and he poses the question of the order of their ranking. This he decides on the basis of the ontological criteria of unchangeability and subsistence. The objects of mathematics are unchanging, but they do not subsist separated from material things. Perceptible substances, with which physics or 'second philosophy' (*Met.* VII, 11) occupies itself, change. On the other hand, both ontological characteristics belong to the object of theology, which is therefore designated as 'first philosophy'. Whether there exists such an unchanging, divine substance, and with it a first philosophy in this sense, remains open.

However, besides theology, the science of being as being, introduced in *Metaphysics*, IV, 1 and VI, 1, presents a claim to the title of first philosophy, because it has the most comprehensive realm of objects. Aristotle resolves the dilemma over this and the above-mentioned determination via the suggestion

that we have to do here with one and the same science. The science of the divine substance is the universal science of being, because it is the science of the first and most outstanding being. The unity of both sciences is given from the unity by analogy of the concept of being. All being depends upon perceptible changing substance and ultimately, if there be such, upon the unchangeable divine substance, which is therefore the primary object of the science of being as being (*Met.* IV, 2). An earlier sketch of first philosophy is *Metaphysics* XII, where, proceeding from changeable substance, the existence of the unmoved mover is proved and described in detail. The later realization of this idea in *Metaphysics* VII–IX moves from the accidents to the perceptible substance, the principle of which is the immutable form, and only a brief reference is here made to unchangeable substance (*Met.* IX, 8). Immutable form is here understood in terms of the capability for an activity.

In *Metaphysics* IV, 3, Aristotle demonstrates that the objects of the science of being as being include also the 'axioms' which all other sciences use, for example the principle of contradiction (IV, 4) and that of the excluded middle (IV, 7). Because these hold true of being as being, the universal science of being has competence with regard to them, too. And because each science concerns itself with some genus of being, these axioms are needed in each. It is in this connection in Book XI, whose authenticity is contested, that the expression 'first philosophy' is used. This science considers the general principles which mathematics and physics will then make more specific use of in their respective object domains.

First Philosophy as Foundation of the Sciences. It is above all in this third sense that the tradition takes up the expression 'first philosophy'. In the Proemium of his commentary on the *Metaphysics*, Thomas Aquinas writes that the investigation is called theology, in as much as it considers immaterial substances, and metaphysics, in as much as it regards being as being. He applies the designation 'first philosophy', just as Francisco Suárez would later do (*Disp. Met.* I), to the science of the 'first causes' of things, that is, to the concept of *Metaphysics* I, 1f. More important is Aquinas's *In Boet. de Trin.* (q.5, a.1 c), where this science is called first philosophy "in as much as the other sciences follow it in that they receive their principles from it". For Francis Bacon (*De dignitate et augmentis scientarum* III 1–4), first philosophy is the mother of the other sciences; it encompasses the common axioms and such 'transcendental' determinations of the several sciences as: many, few, like, different, being, non-being, and so on. Bacon distinguishes first philosophy from natural theology and introduces a new concept of metaphysics: metaphysics is a part of natural philosophy which investigates, of the four Aristotelian causes, the *forma* and the *finis*; while physics restricts itself to the *causa efficiens* and the *materia*.

René Descartes uses 'first philosophy' synonymously with 'metaphysics'. It is the science of the 'principles of knowledge', but, in so far as all clear and simple representations pertain to these principles, it takes over the tasks of both theology and the universal science of being. These principles would include the attributes of God and the immateriality of the soul.

In Christian Wolff's *Philosophia prima sive ontologia*, 'ontology' pertains to the object, *ens in genere*, while 'first philosophy' teaches the first principles and concepts of thought. According to Edmund Husserl (*Erste Philosophie*, 1923–4), first philosophy must "precede all other philosophical disciplines, to found them methodologically and theoretically" (I, p. 5). It is possible only as a "science of transcendental subjectivity" from which "all genuine sciences derive the origin of their fundamental concepts and fundamental principles and all other principles of their methods" (II, p. 4).

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FRIEDO RICKEN

Fodor, Jerry

The cognitive sciences comprise the collaborative efforts of psychologists, linguists, neurophysiologists, computer scientists, and philosophers who seek explanations and models of cognitive processes and states. Jerry Fodor (b. 1935) has contributed especially to research in psycholinguistics and to the philosophical foundations of cognitive science. Explanations of behaviour in these sciences refer liberally to mental entities. One chief difficulty comes in stating in unambiguous language what such reference involves. Fodor's own view he calls the Representational Theory of Mind (RTM). RTM consists of the following claims:

1. Mental attitudes are relations to representations.
2. These representations form a kind of 'language of thought'.
3. Psychological processes are computations over these representations.

Naturalistic Accounts of the Mind. RTM can be seen as continuous with a long philosophical tradition of attempts at constructing a *naturalistic* account of the mind. The strongest naturalist view is *central-state type identity*, which sees the mental terms in psychological explanations as referring to neurophysiological states. Unfortunately, this view leaves unanswered how it is that certain physical states possess intentionality: how are my beliefs about Ronald Reagan *about* Ronald Reagan? Moreover, it seems to do less than justice to the ways in which the psychology of thinking subjects seems to depend not on the 'hardware' of the brain but on its 'software' or 'program'. If it is logically possible that Martians and machines have mental states, then mental states and neurophysiological states cannot be identical, even if these two classes should prove to be (contingently) coextensive. More generally, the level of abstraction at which the generalizations of psychology seem to be most naturally pitched cuts across the differences in the physical composition of the systems to which these generalizations apply; in cognitive science, at least, the natural domain for psychological theorizing is: all systems that process information.

Information Processing Models of the Mind. The cognitive psychologists most influential on Fodor's thought were the American psycholinguists George Miller, Roger Brown, Thomas Bever, and Merrill Garrett. They offered, as an alternative to the then predominant behaviourism, information processing models in which behaviour is explained as the product of following *internalized* rules. For example, the fact that every English speaker knows that '*a* loves *b*' means the same as '*b* is loved by *a*' is attributed to his knowing (*cognizing*) a *rule* to this effect. As cognitive psychology developed, it attempted to construct models of the mind which explained cognitive competences. Cognitive psychologists attempted to learn about the nature of the rules the mind follows in, for example, memory retrieval, by collecting data on the length of time it takes a subject to recall an item and on the pattern of errors he makes in a sequence of recall trials.

Mental States. The rejection of behaviourism and identity theory involved, as Fodor conceived matters, the postulation of internal mental states which in some way represented information and rules. This called for a *relational* account of mental states that abstracts them from the physical structures of their bearers. Mental states are those internal states which are typically caused by certain kinds of stimuli and which typically cause certain kinds of behaviour and other internal states. This view is *functionalism*. According to it, mental states can be defined by their causal relations to other mental states and to other states, for example, to actions.

Mind as a Computer. According to Fodor's RTM, there is a level of abstraction at which the mind can be described as a computational machine. To be in a mental state, for example to believe that the downstairs neighbour is at the door, is to bear a particular computational relation to an internal representation which means that the downstairs neighbour is at the door. These computations may be initiated by external stimuli and may result in the production of behaviour.

Language of Thought. According to RTM, the intentionality of psychological attitudes is

accounted for in terms of the intentionality of representations of a so-called 'language of thought'. Fodor is quite serious, witness his books *The Language of Thought* and *Representations*, that positing an internal language of thought not only underlies a good deal of work in cognitive psychology but provides the best account we have of the nature of mental states. But what is the nature of this language of thought? Fodor has argued that the language in which we think cannot be any natural language, since every natural language is learned and the language of thought is needed not least in order to account for language learning; otherwise, we run into an infinite regress. Understanding sentences in a natural language involves in his view a kind of translation into the language of thought. But if this is correct, then the language of thought must have an expressive power at least as great as that of any natural language. Indeed, any thought that can be entertained by a human being must be expressible in the *lingua mentis* since entertaining a thought is just being appropriately related to a symbol in the language of thought.

Intentionality. There is an important gap in RTM's attempt to construct a naturalistic theory of mind which Fodor in his recent book, *Psychosemantics*, has begun to address. How does a symbol in the language of thought, which is after all instantiated in human beings by a particular kind of neural event, come to have its meaning? Fodor's answer is to explain the intentionality of a symbol in terms of certain information that occurrences of the symbol carry. The notion of information involved here is the one we have in mind when we assert that 'Smoke means fire'. It is a purely naturalistic notion. The simplest version of this account claims that a symbol in the language of thought refers, say, to cats just in case its occurrence carries the information that a cat is in the vicinity. Whether this sort of account can be made to work is yet to be seen. If it can, then Fodor can lay claim to having solved the Cartesian mind–body problem, or at least that part of the problem having to do with psychological attitudes. By identifying these attitudes with computational relations to representations in a language of thought and explaining the intentionality of these representations in purely naturalistic terms, he would have shown (a) how mental states can possess intentionality; (b) how they can have causal properties; and (c) how, if the brain is a computational machine, mental states can be instantiated by a purely physical and natural object.

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ERNEST LEPORE

Fonseca, Peter of

Peter of Fonseca (Pedro da Fonseca) was born in 1528 in Cortiçada (now Proença-a-Nova) and died in 1599 in Lisbon. Later named the 'Portuguese Aristotle', he was one of the most prominent philosophers of the scholastic renewal which took place in the Iberian peninsula during the 16th century. Fonseca entered the Jesuit order in 1548, and his name is strictly connected with the development of the Jesuit Coimbra College (*Collegium Conimbricensis*), probably the most influential scholastic institution of the time in Portugal, where he studied and taught.

The *Institutionum dialecticarum libri octo* (Lisbon 1564; modern ed. by J. Ferreira Gomez, Coimbra 1964), a detailed treatise on logic on the model of Peter of Spain's *Summulae logicales*, had a widespread diffusion throughout Europe, with no fewer than 53 editions between 1564 and 1625. Fonseca's logic interprets the traditional emphasis on terms by giving a theoretical priority to the conceptual moment over the judicative one (truth and falsity are in concepts rather than in judgement), and, among concepts, to singulars over abstracts and universals. Interesting also is that Fonseca attributes to modal concepts the role of indicating the 'temporal quantity' of the

proposition, a theory that will be criticized in Germany during the first half of the subsequent century.

The most relevant among Fonseca's works is, however, his monumental commentary on Aristotle's *Metaphysics* (*Commentariorum in libros Metaphysicorum Aristotelis Stagiritae Tomi IV*, 1577–1612). Here Fonseca gives a philologically accurate Greek text, together with a Latin translation that Francisco Suárez (who often refers to Fonseca in his *Metaphysicae disputationes*) considered to be "so clear and elegant, as to be understandable by anyone without the need of an exposition". The Aristotelian text is accompanied by a detailed commentary and, at the end of each chapter, by a group of highly original *quaestiones*.

Fonseca considered himself a Thomist; the strong influence of the Thomistic tradition, however, is accompanied in him by elements of Scotism and, occasionally, even of nominalism. His theory of knowledge refused any intermediate entity between the singular object known and the intellect: knowledge is given by immediate correspondence between object and intellect. On the widely debated problem of the differentiation between the essence and the existence of created beings, Fonseca (partly following the Scotist tradition) maintains that the distinction arises 'from the nature of the thing' (*ex natura rei*). It is considered neither as completely real, nor as merely formal, but is rather 'modal', and compared to the difference between warmth and a specific degree of warmth.

In order to reconcile God's foreknowledge and human free will, and to handle the problem of future contingents, Fonseca developed, independently from Luis de Molina (1535–1600), the theory of the *scientia media*, or, as he often says, of 'conditioned futures', by which God foreknows all the consequences of any possible free decision.

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GINO RONCAGLIA

Forces

Forces sue for admission to our ontology on two counts: one experiential and the other theoretical. We feel pressures, pushes, and pulls all the time, and we also experience the effort of deliberately exerting forces on things around us. So there is some reason for taking forces to be objects of direct experience. Yet it is also possible to interpret experience differently, to take bodies to be the objects of experience, and forces to be merely mediators between outer objects and inner experiences. For instance, we may say we feel the floor, not the force it exerts on our foot. The notion of force is thereby extracted from its experiential base, and made theoretical.

The ancient problem of *change* generates the theoretical ground for admitting forces into our ontology. When a thing changes, we believe there must be something which *made it* change – something which made its change of properties *necessary*. Forces are the things which provide a grounding for natural necessities.

This helps to explain why philosophers as diverse as Aristotle, Galileo, and René Descartes believed that all forces must operate by contact between bodies, that there could be no direct action at a distance. In the case of contact forces, an explanation could be given of the necessity linking cause to effect. It was taken to be a self-evident truth that two bodies could not occupy the same region of space at the same time. If one body stands in the path of another's motion, then it follows of necessity that either the moving one will stop, or else the stationary one will have to move to make room for it.

The laws governing such interactions did not come easily to science; but however they work in detail, the supposedly necessary impenetrability of matter does enter in as a ground for a necessary connection between cause and effect. Thus the necessity residing in contact forces is not mere magic, but is grounded in the nature of matter.

For this reason, it was hard for scientists and philosophers to accept non-contact forces. Galileo, for instance, believed the tides were caused by the motion of the Earth; he thought it superstition to think the tides might be caused by the moon. Similarly, Sir Isaac Newton said he "made no hypotheses" about what *exerted* the force of gravity, but merely deduced from the phenomena that there is a force acting on any pair of bodies, and its strength is inversely proportional to the square of the distance between them.

Since Newton, however, we have learned to think of so-called contact forces as short-range inverse square laws. Forces have thus become both *occult*, since they are construed as unobservable, and *magical*, their necessity no longer being grounded in impenetrability, and no alternative ground being provided.

This furnishes strong motivation for eliminating forces altogether from our metaphysics of nature. George Berkeley replaced the force of gravity by the will of God; and David Hume dispensed with gravity altogether, leaving only constant conjunctions between motions of bodies and no invisible, modal intermediaries.

If forces are to earn a secure place in our ontology, we will need to find some replacement for sheer impenetrability, as a ground for the natural necessities they entail.

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JOHN C. BIGELOW

Form/Matter I: Greek and Medieval Theories

The distinction between form and matter is due primarily to Aristotle, although the ground for it was laid by Plato and its application was much extended in medieval philosophy. Aristotle presents it as arising from the analysis of *change*: what comes to be does so *out of* something, there must always be something *underlying* what is coming to be. In the case of accidental change, coming to be such-and-such, the substance undergoing the change is what underlies it. But in the case of substantial change, when something comes to be or to exist, there is *ex hypothesi* no underlying substance; what underlies is the matter out of which the substance comes into existence. Aristotle's favourite example is a statue coming to be out of marble or bronze (*Phys.* 1.7).

The form is then the shape (μορφή) of the statue. So far the distinction is perfectly intelligible and unproblematic, a contrast between the shape or, more generally, structure of a substance and the material of which it is made. But Aristotle also wanted to link it to form in the Platonic sense (εἶδος, which also means 'species'). A species is defined by its genus and differentia, which tells us what it is to be whatever it is (τὸ τί ἦν εἶναι), so that it is also the form (*Met.* 7.4–6). We must understand this more as classification than definition, the result of examining the thing in question and not merely giving the meaning of the word for it. Thus a classification based on structure would bring the two senses of 'form' together, though otherwise there can be a tension between them.

Inspired by Plato's 'receptacle' (*Timaeus* 49C7–50B5), Aristotle also extended the notion of matter in order to explain changes between the four basic elements (earth, air, fire, water) in accordance with his principle that something must underlie and persist through every change. This had to be the ultimate 'stuff' of the world, prime matter, and, as such, would have no properties (*Met.* 7.3, especially 1029a20). Matter/form could then be presented as a special case of potentiality/actualization: each material is potentially (can be made into) many different

things, and prime matter into anything at all (*Met.* 9.7). We have, accordingly, no experience of prime matter, which, to be actual, must always have some form.

Historically, the most important application of the distinction was to organisms, where Aristotle identified soul with the form of the body, distinguishing vegetative soul (plants), perceptory soul (animals), and rational soul (man) (*De An.* 2.1–3). Later, Avicebron (*c.* 1021–*c.* 57/70) argued that each of these forms exists in man (*The Source of Life*, 5) and, as a result of his influence upon medieval philosophers, the question was much discussed at the University of Paris in the 1270s, Aquinas arguing that, on the contrary, the lower forms are subsumed in the higher.

The distinction was even applied by one of the Aristotelian commentators, Alexander of Aphrodisias, to the intellect itself, Aristotle's passive intellect ('the place of forms', Anaxagoras) being regarded as the matter of the intellect and his active intellect as its form. In the same spirit, Avicebron (*The Source of Life*, 3) extended form/matter to spiritual substances (e.g. angels), which were supposed to be composed of spiritual matter and a form. This conveniently made form/matter characteristic of everything apart from God but, by this stage, the distinction had long 'gone on holiday'.

The view that soul is the form of the body avoids the difficulties in accounting for the unity of a living organism which beset Platonic and Cartesian dualism, but at the price of making it difficult to understand how soul could exist separately. Aristotle was notoriously enigmatic upon this point (*De An.* 3.5) and those who, like Aquinas, rejected spiritual matter have fallen back upon a notion of *individualized forms* which seems to originate in Aristotle's account of what is said of a subject but is not in a subject (*Cat.* 2). Yet it is difficult to see how there could be a form which only one substance *could* have, and thus Aquinas held that each angel made up a different species.

Many medieval philosophers held that prime matter is the principle of individuation, in the sense that it is what constitutes the difference between two substances of the same kind at the same time, since these are, *ex hypothesi*, indistinguishable on the side of form. But if, in contrast, we ask in virtue of what a single substance remains the same over a period of time, the answer may well be 'its form', as, e.g. with a human being, most of whose matter is entirely replaced every seven years.

In sum, the form/matter distinction has proved so useful in philosophy as to have become indispensable, but it has sometimes been asked to do *too* much work, as with extensions like prime matter and individualized forms.

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TIMOTHY C. POTTS

Form/Matter II: From Aristotle to Kant

Of all pairs of contrasting terms, *matter and form* is perhaps the best known and the most frequently used, not only in philosophy, but in everyday speech as well. The elaboration of the concepts of matter and form goes back to Aristotle, who used them to explain substantial change, i.e. generation and corruption of bodily substances. Following the pre-Socratic philosophers, Aristotle conceived the generation of a substance as a process of in-forming of primary matter by a substantial form through the action of a generating physical agent (corruption being the contrary process). Aristotle sets up an analogy which implies an essential difference between substantial genesis and accidental genesis; in accidental genesis, substance has the role of matter in relation to an accidental form. Issuing from this initial model, the matter–form pair is gradually applied to other domains of reality. It eventually applies in

general to the relation of any *determinable* to any *determinant*.

Extension of the Notions. In Aristotle, the concepts of matter and form help us to understand the relations between a series of different terms: between operative potentiality and act (philosophy of nature, specifically pertaining to living beings); between substance (οὐσία) and actuality (ἐνέργεια) (the metaphysical analysis of what is in as much as it is); between an act (*operatio*) of a living being and its virtue, which is the perfection of the act (principally ethics); between perceptual or intellectual acts and perceptible or intelligible objects (theory of knowledge); between voluntary acts of desire and desirable objects (ethics); between concept and oral or written sound (philosophy of language); between logical proposition and literary expression (rhetoric and poetics); between stuff and figure, content and form in works of art (aesthetics).

Matter and Form in Kant. The extremely common use of the concepts of matter and form is such that these can be found in just about every philosophical system dealing specifically with any of Aristotle's fields of investigation, ranging from philosophy of nature to philosophy of language and aesthetics. A particularly interesting case is presented by Kant's use of these concepts in his transcendental logic. Medieval logic had already developed the distinction between logical form and logical matter, i.e. the distinction between the mode of an object's being known and the known object itself. The subject–predicate logical form is an example of a form in this sense. Logical form is here the subjective determinating principle, the known object is the determinable logical matter. But Kant, like any faithful disciple of Duns Scotus, rejects the formal determination by the object of the act of knowing. Thus it is relatively easy to understand how Kant retains in the act of knowing merely the subjective formal determination of the phenomenal content of perception via pure intuitions and concepts considered as *a priori* subjective forms of matter, the latter being empirically given in sense-perception. Kant's 'Copernican Revolution' thus appears to be a transcendental hypostasis of the medieval conception of the logical in-forming of the known object, in the absence of any objective determination of the knowing subject by the real, cognizable object.

The Relation of Matter and Form is not Univocal. The very widespread use of the terms 'matter' and 'form' should not be allowed to suggest that the relation linking the corresponding entities is a univocal relation. Matter does not relate to form in exactly the same way in all the aforementioned applications of these terms. For, in speaking of a form, one sometimes means actuality; but if every actuality is a form, not every form is an actuality. The Western tradition has recurrently failed to appreciate this distinction, which is based on the Aristotelian metaphysical opposition between the analysis of that which is *qua* substance and the analysis of that which is *qua* actuality.

On one hand, form determines matter *in the order of the quidditative constitution of substance*. Form can thus be *per se* a substantial or an accidental determination; and from this formal-quidditative point of view, the concrete existential actuality (or *exercitus*) of a thing can be considered an accident of the substance. But on the other hand, actuality determines substantial potentiality by actualizing it *in the order of exercitus*; it actualizes it as its own proper perfection, not at all like an accident: from this second point of view, actuality is potentiality at its highest concrete degree. (One must therefore clearly distinguish potentiality from possibility, contrary to the unfortunate identification of these terms, frequent since John Duns Scotus.)

With these two points of view in mind, one can ensure an orderly account of the previously listed applications of the notions of matter and form. Apart from the application of these concepts to cases of the quidditative or accidental constitution of a substantial whole, whether it be physical or aesthetic, all the other cases mentioned have to do with the exercising of form as actuality. This is obvious in the case of the act of a living being in relation to its virtue; it is also obvious in the case of a cognitive or volitional act in relation to its proper object, although this has been denied by the dominant current of Western thought. It is obvious, furthermore, in the

case of the known object in relation to logical form. Finally, it is obvious principally in the case of potentiality in relation to actuality. Actuality in relation to substance as such can be considered as a form *per accidens*. Whereas actuality in relation to substance *qua* potentiality must be considered as actual perfection *per se*.

Matter, Form and Causality. The relation between matter and form is a causal one. In the case of a substantial whole, Aristotle conceived of matter and form as two total and reciprocal causes, the one material, the other formal. Their effect, which is a substantial whole, is not an effect they produce in common, that is to say, it is not some third entity distinct from both of them. Their effect is their actual and reciprocal causation; the causation exerted by each one on the other is total, in as much as matter and form are both specific causes. This is why, by analogy, subject and object are inseparable in any cognitive or volitional act. For, in their own way, they are reciprocal and total causes of the specific causation exerted by the one on the other; and it is precisely this actual causation which is their effect. This point of view lays a foundation for an objective, realistic conception of all cognitive acts and for the finality *per se* of all volitional acts (since this point of view entails the denial of all *a priori* knowledge, it requires that mathematics be defined as an empirical science). The Western tradition since John Duns Scotus has, however, construed the dualism of matter and form as the concurring of two principles in a substantial whole, as if, in the substantial whole, there were two non-reciprocal part-causes concurring to the production of an effect which is a third term. Hence, matter no longer brings to form, nor form to matter, any actuality whatsoever; and the same can be said of the relation between agent and end. The upshot is that cognitive acts are cut off from any formal objective determination, just as volitional acts cease to have their natural objects as ends. At this point, the modern conception of causality is born, and so are the modern notions of *a priori* knowledge and absolute freedom. This is where the secret spring of Kant's 'Copernican Revolution' lies.

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ANDRÉ DE MURALT

Fractals. See: Chaos II

Frege, Gottlob

Gottlob Frege (1848–1925) lived his life in relative obscurity. He corresponded with some of the great mathematicians of the age, but excepting Bertrand Russell was largely unappreciated by them. He also corresponded with Ludwig Wittgenstein, and was heard in lecture by Rudolf Carnap. These three, particularly Russell, expanded his public and kept his reputation alive. His philosophical importance came to be widely appreciated, however, only in the middle of this century. He is now regarded as the father of analytic philosophy.

Frege founded modern logic. In 1879 he published his *Begriffsschrift*, which constituted the first fundamental advance in logic since Aristotle. In this work, Frege stated the syntax and semantics for the propositional calculus and first and second-order quantificational logic. The standard of rigour that he brought to this work was unprecedented.

Frege's work in logic is his greatest contribution. But it was conceived primarily as a means to a further end. He wanted to establish *logicism*, the view that the mathematics of number is reducible to logic. This view derives from Leibniz; but before Frege no one had a sufficiently rigorous or powerful logic to argue for it in a systematic way.

In *Die Grundlagen der Arithmetik*, 1884, Frege set out to define the primary expressions of arithmetic in purely logical terms. The key expressions were '0', 'the successor of', and 'natural number'. Using these defini-

tions he hoped to prove within his logic the theorems of arithmetic. This latter task he reserved to *Die Grundgesetze der Arithmetik* (1st volume 1893; 2nd, 1903).

In the *Grundlagen*, one of the most brilliant of all works in philosophy, Frege criticized rival views in the philosophy of mathematics – particularly empiricist, psychologistic, and Kantian views – as a way of motivating the definitions that he proposed. Although his project was conceived as a mathematical one, his genius lay in the deep philosophical motivations that he developed for it. Nearly all of Frege's criticisms of the views he discusses, in the particular forms that he discusses them, are regarded as devastating.

Frege argues that numbers, though abstract and causally inert, are objective. It is disputed whether Frege held the Platonist view that numbers are abstract (not in space and time) and completely independent of minds for their existence and character. But the preponderance of evidence, which grows as his career unfolds, suggests that he was an ontological Platonist, not only about numbers but about functions, thought contents, and various other abstract entities. Frege did not, however, maintain a Platonist epistemology: he did not hold that we have a special intuitive faculty for apprehending abstract objects like numbers. Rather he developed the rudiments of a modern 'pragmatic' epistemology, one of his most distinctive philosophical achievements.

The key to Frege's pragmatic epistemology lies in his 'context principles', which are stated in various non-equivalent ways in the *Grundlagen*. Simplifying, the idea is that one's conception of reference should be derivative from the analysis of the role of expressions (particularly singular expressions) in true propositions. One determines the true propositions, in the usual way, within successful cognitive practice. One identifies successful cognitive practice by seeing what enterprises produce successful communication and reasoned agreement. The content of this doctrine can be seen more clearly in its application to mathematics. Mathematics counts as successful cognitive practice because it yields successful communication, and agreement according to rational, checkable procedures. So its fundamental theorems should be counted true. Given an analysis of the logical form and semantics of truths of mathematics, which Frege carries out, reference to mathematical objects is required for the truth of mathematical theorems. Combined with various arguments that mathematical objects are abstract, the pragmatic epistemology yields a defence of ontological Platonism.

Frege's epistemology rivals a view that would begin by putting constraints on the notion of reference or knowledge (such as the constraint that they have to be accompanied by a causal relation, or be explained in some favoured way). Such a view might argue from the claim that mathematical reference or knowledge cannot meet those constraints, to the view that mathematical theorems are not literally true or to the view that mathematics cannot be committed to abstract objects. Frege would regard such a procedure as backwards.

Frege's definitions in *Grundlagen* of the key mathematical terms are very close to those that would be given today. But they rely on the notion of an *extension of a concept*. In a footnote in Section 68 and in Section 107, Frege exhibits some unclarity about this notion. Much of his work between 1884 and 1993 was an attempt to clarify the notion, and to justify the key axiom that made use of the notion. This axiom states that all and only Fs are Gs if and only if the extension of F is identical with the extension of G. This axiom was a key to Frege's logicism. Frege found it less obvious than his other axioms. (Cf. a remark in the Introduction to the *Grundgesetze*.)

Again, some of Frege's greatest contributions came as means to a further end. His ground-breaking theory of language in "Function and Concept" (1891), "Concept and Object" (1892), and "On Sense and Denotation" (1892) was motivated by the desire to clarify the key notion and justify the key axiom. In these articles, Frege proposed to analyse language in such a way that the semantical value of complex expressions would be shown to be a function of the semantical values of their parts. To this end, he took predicates to denote functions. The

functions, which he called 'first-level concepts', take objects as arguments and yield truth or falsity as values. Higher-level concepts take functions as arguments and again yield truth values as values. This analysis was the first systematic statement of a compositional, truth-conditional semantics. Such an approach has dominated philosophy of language in this century.

Frege also developed a distinction between sense and denotation (*Sinn* and *Bedeutung*). The distinction was introduced by an example. In a true sentence of the form '$a = b$', the denotations or referents of the two proper names are the same. So at the level of denotation, true sentences of that form do not differ from sentences of the form '$a = a$'. But identities of such forms typically differ in what they express; their cognitive values typically differ. Frege proposed that the senses that their respective parts express differ, even though the referents or denotations are the same.

Frege produced parallel compositional theories of sense and denotation. The denotation of a (declarative) sentence was held to be a truth value. The sense of such a sentence was held to be an abstract thought. The theory of sense enters in an elegant and plausible way into Frege's account of intensional contexts. (An intensional context is a linguistic context in which exchange of expressions that are ordinarily codenotational does not appear to preserve the denotation of expressions within which the exchange is carried out.) Simplifying slightly, Frege held that in such contexts, expressions denoted their ordinary senses rather than their ordinary denotations, and that substitution of codenotational expressions *in the context* preserves the denotations of the containing expressions. For example, in 'Al believes $2 + 2 = 4$', the expression '$2 + 2 = 4$' denotes not a truth-value, but a thought. Exchange of sentences with the same truth-value as '$2 + 2 = 4$' will not necessarily preserve the denotation (truth-value) of the whole belief-sentence; only exchange of sentences that ordinarily express the same thought will do so – since in the context, '$2 + 2 = 4$' denotes a thought, not a truth-value. Thus Frege identified some of the primary problems in modern semantics and produced a fruitful and arguably correct strategy for dealing with them.

Frege's notion of sense is less familiar than it may at first seem to be. Although he did associate senses with expressions of natural languages, he did not (or did not in general) identify senses with what moderns would count as conventional linguistic meanings. His primary notion for understanding senses was that of a cognitive value, not what is conventionally or normally understood by an expression in a community. He thought that the senses of demonstratives vary with almost each occasion of use, though the conventional linguistic meanings of demonstratives do not thus vary. The idea is that the user's perspective on the world varies with each use. Frege did not believe that sense varied for non-demonstrative expressions to that extent. But he did identify sense with a more idealized conception of cognitive value than would be common today. In fact, he tended to think of senses of non-context-dependent expressions in natural languages as what would be understood by speakers of the language if the speakers had perfected the language for the purposes of knowing about the world (including the world of mathematics) and of expressing that knowledge in an ideally perspicuous way. Thus it was coherent to suppose, from Frege's point of view, that no one could fully and correctly explicate the sense of some expression that was in common use. The sense of an expression might depend on a rationale for its use that was implicit in that use, but that no one had yet come to understand. Thus the sense of number expressions would be fully explicated only when logicism was fully established and articulated. Frege thought that fully understanding (in the sense of being able to explicate) the sense of an expression in a language was not in general separable from understanding the reality that the language was used in knowing.

The sense-denotation distinction remains important in theories of language and cognition. But Frege marshalled it to justify his ill-fated axiom. He developed an intricate argument for claiming that the two sides of the main biconditional in the axiom had the same sense. If this were true, the axiom

would clearly be true. But Russell's paradox, which Frege learned of in a letter from Russell in 1902, showed that Frege's axiom is false. This result undermined Frege's version of logicism. Frege's notion of the extension of a concept was never fully clarified. Frege's primary ends were thwarted. But his contributions to logic from 1879 were independent of the axiom. And many of his contributions to philosophy of mathematics and language and to epistemology are of permanent value.

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TYLER BURGE

Function, Functional Dependence

The term 'function' is derived from the Latin *fungi*, which can be translated as 'to function, to do one's duty, to perform, to carry out a task'. In a social or legal sense an official can do his duties; in a biological sense 'function' means the action of an organ fulfilling its role. Thus Cicero (106–43 BC) spoke of the *functiones corporis et animi* (*Tusculanae disputationes*, II, 35). The teleological use of 'function' corresponds to the use in ordinary language (e.g. 'the function of x is to do y').

The mathematical concept of function was introduced by Leibniz in 1673 – two years before his revolutionary discovery of the calculus. He published his concept of function for the first time in 1692 in a paper in the *Acta Eruditorum* in which he also introduced into mathematics the terms 'coordinate', 'variable', and 'constant'. There 'function' signifies geometrical quantities or line segments (e.g. the tangent, the ordinates or *abscissae*), which depend on a variable point of the curve. The mathematical use is borrowed from the teleological: the mathematical functions function as indicators of the curvature of a curve.

In his important work *Introductio in analysin infinitorum*, Leonhard Euler (1707–83) frees the concept of function from the framework of geometry by defining the function of a variable quantity as an 'analytic formula (*expressio analytica*) which is in some way constructed from variables and constants'. Functions, for Euler, thus obey an algebraically expressible law or formula. In his *Institutiones calculi differentialis*, Euler extends the concept of a function to the concept of arbitrary dependence:

> Functions are quantities which depend on other quantities in such a way that, if the former are changed, the latter will be changed as well. This determination extends to all possible ways in which one quantity can be determined by another.

Gottlob Frege then generalized the mathematical concept of function by lifting all restrictions not only on what operations can play a role in the specification of a function but also on what entities (not only quantities) a function can take as arguments and values. In modern mathematics a function-term (or map or mapping) is an n-ary relation-term with the property of being a univalent correspondence. That is, every function-term determines one and only one value for any given argument.

The mathematical concept of function was connected by Kant with the legal or biological concept. In his *Critique of Pure Reason*, Kant calls a function of the active understanding a mental unity which arranges different ideas under a common one (B 93). These functions lay the foundation for all concepts and are, as actions of the understanding, judgements. Hence they play a constitutive role in knowledge. Kant therefore prepares the way for the application of the concept of function in logic, in the theory of knowledge and in ontology. His transcendental approach, in which functions as elements of consciousness

figure as principles of knowing phenomena, makes explicit an ontology of functions which was already latent in science.

In science, the concept of function became a basic concept because laws of nature have the form of functions, relations, or structures. That which exists, the inner essence, is thus no longer understood as a substance but rather as a function or a law (neo-Kantianism, Ernst Cassirer, Alfred N. Whitehead). In an ontology of substances things are ultimate, separable entities and bearers of properties; in an ontology of functions things exist only in relation to other things, as parts of a system. Things, in such an ontology, are analysed in terms of their relations to other things, relations which are governed by natural law.

This tendency is reflected in logic, where, after Kant, Frege introduces the mathematical concept of function in his paper "Function and Concept" of 1891. Here a concept is understood as a certain sort of function, namely a function whose value is always a truth-value. Frege analyses judgeable content into function and argument. Thus the singular terms in a proposition figure as arguments, the remainder of the proposition (Bertrand Russell's 'propositional function') figure as the function. Thus functions are unsaturated expressions, which when saturated, i.e. when we insert constants into the empty argument places, turn into meaningful propositions. The function/argument articulation of every judgeable content replaces the old rather grammatically and ontologically (substance-accident) oriented subject/predicate form. This change is far from being only the one which takes us from a grammatical to a mathematical terminology; it rather constitutes a revolution in logic: the logic of relations (now expressed as *n*-ary functions) can be introduced in a truly new way, as also can the logic of quantifiers. A relation must not be interpreted as an accident in a substance (subject), but can be distinguished from properties by the number of argument-places. In the subject/predicate logic the quantifier belongs to the subject: e.g. the expression 'all swans' in the proposition 'all swans are white' stands for the class of swans, whereas in modern logic the quantifier refers to the whole propositional function, so that we analyse: for all objects x: if x is a swan, then it is white.

In contemporary philosophy of science the concept of function is often investigated because it is linked with teleological explanation. Functional statements are given as answers to the question why. Such explanations are common in biology, sociology, psychology, and anthropology. From Francis Bacon to Jacques Monod it has often been argued that the only form of scientific explanations is the causal one. It is for this reason that philosophers are trying to transform functional explanations into causal ones or to show that functional explanations are adequate for certain areas only.

On the other hand, because systems can be functionally characterized, in many areas 'functionalisms' arise; in the topic of the mind/brain/body-relation for example, functionalism, as a descendant of behaviourism, is a popular general approach. Every mental phenomenon is what it does, and therefore must be defined in terms of how it works or functions. Other topics in this discussion are therefore how functional explanations can be correctly transformed into causal ones, how they can be correctly formalized from the point of view of formal logic, and what empirical significance they have.

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Fusion

Although the concept of fusion (*Verschmelzung*) appears in the early 19th-century psychological literature, the first important use is to be found in Carl Stumpf's *Tonpsychologie*

(1883–90), where it is introduced to explain some problematic aspects of the theory of musical consonance. In opposition to the theory presented by Hermann von Helmholtz (1821–94) in his *Sensations of Tones* (1862), Stumpf seeks to avoid reductionist (physiological or physical) accounts of the qualitative phenomenon of perceived consonance. Instead he formulates his account in terms of two intrinsically qualitative features of certain patterns of simultaneous sounds, namely:

1. relative *indistinguishability* of the single sounds in the general pattern (e.g. a chord), and
2. the difficulty we experience in *analysing* the pattern itself.

Stumpf says of a perceptual pattern exhibiting these features that fusion obtains among its parts. An example from the visual domain would be the fusion between two adjacent shadows. Stumpf propounds '*Schmalz*', '*Schmelz*', and '*Auseinandertreten*' as synonyms. His most general definition is "that relation between two contents, especially sensory contents, in which they make not a mere sum, but a whole" and which is such "that with its higher degrees, the general impression comes close to that of a single sensation".

Stumpf seems to adopt J. F. Herbart's definition in the *Psychologie als Wissenschaft* (Königsberg: Unzer, 1824, §§ 67–73), according to which fusion is "the unification of those representations belonging to a single sensory continuum" (e.g. the unification of blue and red into violet). Herbart sets forth in a mathematical fashion a "general method for calculating fusions", by taking into account the relative distance of the fused representations.

To demonstrate the adequacy of the concept to the explanation of consonance, Stumpf performs a series of experiments with non-musically trained subjects, which demonstrate a parallelism between judgements of relative fusion and the classical statements of the theory of consonance. Thus, for example, the maximally consonant intervals – the octaves – are labelled as maximally fused, and with decreasing degrees of consonance we find decreasing degrees of fusion.

In the subsequent evolution of Stumpf's own theory of consonance, the notion of fusion ceases to have an explanatory role. Stumpf's uncertainty concerned mainly the relations between the physical property of consonance, the perceptual property of fusion, and the perceptual property of consonance. He tried both (i) to reduce and (ii) to equate consonance to fusion, two tasks which are not compatible, and which expose themselves to criticism.

Ad (i): the reduction was pursued by postulating a causal link between the two: fusion is supposed to cause perceptual consonance. Now, it is possible to admit a more or less strong causal relation between *physical* consonance and fusion, but it is quite unclear what sort of causal relation if any there could be between two *perceptual* properties.

Ad (ii): the equation of consonance and fusion implies the redundancy of the concept of consonance. Stumpf's claim relies on his rejection of the widely accepted two-component theory, according to which we can individuate sounds by an appeal to their quality (*c*, *f*, etc.) and their pitch (c_1, c_2, etc.): for Stumpf it is pitch alone that is responsible for individuation in the sound field. Given a series of pitches, we just have to see between which of the corresponding sounds we find high or low fusion, and this would create an order corresponding to the order of consonance of the musical tradition (*c*–*g* would be more fused than *c*–*f*, which in turn would be more fused than *c*–*e*, and so on). Then, however, it is redundant to appeal either to physical consonance (because the perceptual explication suffices), or to perceptual consonance (because this concept collapses into that of fusion).

Franz Brentano's criticism of Stumpf's account, in his *Untersuchungen zur Sinnespsychologie* (1907), is based on a resuscitation of the two-component theory: he distinguishes between the quality and what he calls the brightness of a sound. Quality presents itself iterated in octaves, but each iteration up the scale is associated with an increase in bright-

ness. Brentano suggests a broadening of the concept of fusion and then considers the basic case of fusion as explainable in terms of a coparticipation in quality with a difference in brightness (so c_1 fuses with c_2 because they share the same quality, c). In the end Stumpf accepted Brentano's and other criticisms and considered fusion as a concomitant phenomenon (*begleitende Erscheinung*) of the perception of consonance.

A fruitful use of the concept of fusion was made in psychological investigations of perception of both static wholes and of movements. Hans Cornelius (1892–3), criticizing Stumpf, presents a theory of sensation according to which attention can modify sensory contents and, by so doing, alter the perceived fusion. A different use of the concept is made in Gestaltist work on the perception of movement. Wolfgang Metzger, (1899–1985) in 1926 classifies and measures kinds and degrees of unification of successive sensory contents.

In the third *Logical Investigation* (1900–1, §9), Edmund Husserl quotes from Stumpf and explains his notion of *moment* or dependent part by contrasting it with that of *fused part*. An arbitrary extensive part of a surface is *fused* with its neighbours; that is, it is impossible to discriminate them from each other with distinctness. On the other hand, two moments of the same surface – for example colour and shape – are mutually founded on each other, that is to say, they cannot exist independently from each other, though they can be easily discriminated. Once more, it is Stumpf (1873) who first traced a distinction between partial contents (*Teilinhalte*) and fused wholes (together with other distinctions between kinds of compound contents). Husserl's claim is, however, an ontological one, where Stumpf held a weaker, psychological position, talking merely of the possibility of a separate representation of contents, not of their separate existence. It is therefore important for Husserl to deny that fusion could found the ontological distinction between independent and dependent parts; he considers fusion only as the nearest psychological example of our incapability of separate representation.

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G

Galileo Galilei

Galileo (born Pisa, 1564; died Florence, 1642) did more, perhaps, to shape the intellectual style of the 'new science' of the 17th century than did any other single person. His *Dialogue Concerning Two Chief World Systems* (1632) undermined the Aristotelian account of motion that had successfully maintained its authority for 2000 years, and his *Two New Sciences* (1638) laid the groundwork for a mechanics in the modern manner. In addition, in the few short years 1609–13, he amassed a body of evidence with the aid of his newly perfected telescope (lunar mountains, changing sunspots, the moons of Jupiter, and, above all, the phases of Venus) which, skilfully deployed, refuted the Aristotelian–Ptolemaic geocentric model of the universe.

Though his first academic appointments in Pisa (1589–92) and Padua (1592–1610) were in mathematics, it was the application of mathematical ideas to the problems of natural philosophy that mainly interested him. Natural philosophy in the Aristotelian tradition had been largely qualitative; Aristotle had sharply separated mathematics and physics, and proposed a special intermediate status for disciplines like astronomy that seemed to combine both. The predictive

successes of Ptolemaic astronomy led to the separation between the 'mathematicians' (who made use of geometric devices like epicycles) to describe the planetary orbits and the 'physicists' who explained why the planets moved concentrically as they did. Since the two models were incompatible, it was customary to treat the work of the mathematician as hypothetical, a 'hypothesis' here being a convenient device used in prediction but making no claims on reality. When Nicolas Copernicus (1473–1543) proposed a heliocentric world system, it was natural to take it as no more than a predictive device of this sort.

Galileo's arguments shifted the balance. He defeated the Aristotelian objections to the Earth's motion by showing, first, that the sharp separation between the natures of celestial and terrestrial bodies so fundamental to Aristotle's physics was highly questionable; and, second, that the Earth's motion, if uniform, would go unperceived by anyone who shared in it. (There was a troublesome ambiguity as to whether 'inertial' motion, i.e. the motion a moving body would perform if left to itself, is circular or rectilinear). He also questioned the plausibility, on dynamic grounds, of making the sun and stars whirl around the very much smaller Earth. He argued (fallaciously) that the tides could be explained only by attributing a double motion to the Earth. Though fairly persuasive, his case did not amount to demonstration, and demonstration was what was needed (according to traditional principles of Scriptural interpretation) if certain passages in the Bible alluding to the sun's motion or the Earth's stability were to be attributed metaphorical status. The conflict surrounding the publication of his *Dialogue*, and his trial before the Roman Inquisition in 1633, hinged on the apparent challenge the Copernican doctrine posed to biblical inerrancy, which had already led to the withdrawal of Copernicus's work 'for correction' in 1616.

Galileo's impact on the history of philosophy was considerable. The dominant natural philosophy of the late 16th century was that of Aristotle, the philosophy in which Galileo himself was formed and which he taught in his younger days at Padua. But by the mid 17th century, it was under siege and Galileo's new science of motion was the main weapon of attack. Aristotle had made physics the basis of his entire system; without it the system could not be sustained without extensive modification. Though scholastic doctrine continued to be taught at Catholic universities, notably at the Sorbonne, it had lost its authority in the larger realm.

But Galileo's influence was much more profound than this. His new science relied on a distinctive and sophisticated combination of controlled experiment and mathematical idealization. Natural science and philosophy were about to separate, with profound consequences for both. Prior to Galileo, there had been a single field: physics (natural philosophy), with mathematics as a distinct discipline. After Galileo, physics had its own method, and it was definitely not that of metaphysics. In the next generation, it was easy to distinguish 'philosophers' (like John Locke (1632–1704) or Nicolas Malebranche (1638–1715)) from 'scientists' (like Robert Boyle, 1627–91, or Christiaan Huygens, 1629–95), though the terminology to ratify the distinction did not yet exist.

When Edmund Husserl spoke of "science of the Galilean style", he had in mind the mathematization that Galileo wrought upon nature, and the consequent separation between the universe constructed by physical science and the world given to us in perceptual experience. In his mechanics, Galileo represented space and time in geometrical fashion and was able to show that quantity of matter (which, unlike René Descartes, he would not geometrize) was not relevant to the speed of fall *in vacuo*. Hence, he could claim to have discovered a geometry of motion relating the space and time variables directly, and thus to have shown that "the Book of Nature is written in the language of mathematics".

Plato had seen a partial image of the realm of mathematical form in the world of perception. But Galileo saw the correspondence as exact: there was nothing else there in the perceptual world than the underlying mathematically describable structures. His distinction between *primary* prop-

erties, the ones that lend themselves to mathematization and hence to mechanics, and *secondary* properties that are the human mode of access to the world was to become a fundamental presupposition of the 'mechanical philosophy'. Galileo formulated the distinction in its most extreme form; he seemed to make the secondary qualities not just secondary but unreal: the colour is no more in the apple than the tickle is in the feather. In his ontology, only the primary qualities are real; it is not clear how the secondary qualities could afford access to them.

This strong separation, between sensible appearance and an underlying reality describable only in a language which is mathematical in its grammar, was to haunt later philosophy. It is ironic that someone who so effectively distanced himself in his own work from the traditional concerns of 'philosophy' in its metaphysical and epistemological modes should have had such a central role in setting the later agenda of philosophy.

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Gassendi, Pierre

Natural philosophers of the 17th century discovered a powerful ancient Greek precedent for their development of a mechanistic conception of nature when they revived the atomist philosophy of Epicurus (341–271 BC). The principal early exponent of Epicurean atomism was Pierre Gassendi (1592–1655), a professor of mathematics in the Collège Royal in Paris who published in 1649 the first full-scale Latin commentary on the Greek text of Epicurus, which had been preserved in Diogenes Laertius's (3rd century) *Lives and Opinions of Eminent Philosophers*. Gassendi afterwards transformed this commentary into his own atomist treatise, the *Syntagma philosophicum* (1658). In the *Syntagma*, he reiterated many of Epicurus's arguments for the existence and qualities of atoms. Gassendi conceived of his historical reconstruction of Epicurean beliefs as providing a much-needed corrective to the erroneous interpretations of atomism popularized by the 16th-century editions of Sextus Empiricus's *Against the Physicists* and *Against the Geometers*. Sextus (*c.* 150–*c.*225) had held that no geometer's and no physicist's concept of body could render body intelligible because, whatever the concept, he (Sextus) could always infer from it a puzzle about whether the body in question was composed of indivisibles or continuous magnitudes. Such puzzles, he said, would lead one to conclude that body is composed neither from indivisibles nor from continuous magnitudes. Since, however, these two concepts exhaust the possible ways of conceiving of body, he also concluded that the concept of body was unintelligible.

Sextus did not invent the puzzles with which he tried to undermine Greek physics and geometry. Discussions of atomism from the time of Democritus (*c.* 460–*c.* 370 BC) to the late Hellenistic period had regularly alluded to some form of the following dilemma. Either the magnitudes of bodies are indivisible or they are continuous. If they are indivisible, they are only magnitudes in a problematic sense because they lack any divisible parts by which their magnitudes can be measured. If, on the other hand, these bodies are continuous, they must be infinitely divisible because their continuity implies that they are composed of parts which are always divisible. But, if the latter is the case, then these magnitudes become subject to some version of Zeno's paradoxes concerning the infinite divisibility of body, space, and time. What alarmed Gassendi as he compared Sextus's account of ancient atomism with the Greek text of Epicurus was the extent to which Sextus had misconstrued Epicurus's arguments. Sextus had thought it possible to discuss Epicurus's concept of atoms as if it were interchangeable with a geometer's concept of indivisibles. Second, he had ignored

Epicurus's principal arguments for the existence of atoms:

1. that the existence of physical bodies which undergo change is self-evident in sense perception;
2. that physical bodies cannot undergo change unless they are composed of atoms capable of serving as the substratum of change.

Gassendi considered Epicurus's assertion that our knowledge of physical bodies depends on the mutually reinforcing evidence of sense perception and atomist metaphysical principles to be an attractive alternative to a science based on the Aristotelian concept of substance. However, he found the task of confirming that atoms did in fact possess the qualities which Epicurus had claimed for them a difficult one. Such claims had usually amounted to no more than arguments showing that atoms must have *some* size, shape, and motion, or weight. They assigned only an upper and lower limit to size and shape. Atoms could never be so large as to be seen or so small that they became mathematical points. Indefinitely many atomic shapes were possible, although Epicurus had ruled out the possibility of an infinite number of shapes. In the case of motion, he had only specified that all atoms moved at equal speeds through the void unless the swerve of one or more of them interfered with the parallel rectilinear motions of the others.

Gassendi's skill as a natural philosopher is amply demonstrated by the fact that, starting from principles as problematic as these, he was able to define a complete mechanistic conception of nature which was consistent with Galileo's inertial physics and Johannes Kepler's laws in astronomy and optics. But he was not a productive discoverer of empirical laws, and he regarded the study of nature as an endeavour in which the testing of particular laws was subservient to the rational justification of more general theories which explained the structure of nature as a whole. The work of a physicist seemed to him first to involve the task of defining the natural world in such a way that it *could become* an object of empirical enquiry. Only then could the physicist perform actual investigations of that world. Gassendi also attempted a reconciliation of atomism and the Christian religion by arguing for the necessity of God as the Creator and first cause of a world composed of atoms. He distinguished his atomism from materialist philosophies by stipulating, moreover, that the rational soul of man is incorporeal. His originality as an atomist thinker was thus enhanced rather than inhibited by his historical researches on Epicurus because he chose to develop just those atomist principles which could be effectively defended against the rival views of the other major philosophical schools in the Western tradition.

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LYNN S. JOY

Generality

I shall sketch in what follows the problem of general facts, remark on some solutions to it and glance at the effort to discredit it.

Imagine a situation in which someone states truly that all the marbles in this bag are red; and assume that the statement is *made true* by a fact (F_g). What is the *analysis* of F_g? That is the problem. The make-true assumption is the point of attack for the discreditors. Of them, later.

Imagine now a situation in which someone states truly that this (marble) is red. What is the analysis of the fact (F_a) that makes that statement true? That F_a has an analysis – that it is composed of entities somehow connected – is agreed upon by all analytical ontologists: they acknowledge that in some situations one can state truly that both this and that are red.

The analysis of F_a is in dispute; but all agree that no matter the *kinds* of entities of which F_a consists, that which connects them is of a most peculiar sort. Speaking in effect of

an F_a-type fact, the early Ludwig Wittgenstein said that the entities hang together like links in a chain. He did not mean that *absolutely nothing* connects the entities 'into' F_a; rather he meant that the connector is radically different in kind from them. Let C be the connector.

Imagine now a situation in which someone states truly that this is red and that is red. What is the analysis of the fact (F_m) that makes that statement true? Ontologists agree that at least two F_a-type facts figure in the analysis of F_m. Some insist that something else figures; in particular, a connector that is like but different from C. Others insist that F_m consists of only the two F_a-type facts. For what is of concern here, let us accept the latter view.

Consider now F_c. Some hold that it consists of F_a-type facts and *nothing else*: F_c is basically an F_m-type fact. Others hold that F_c is not at all like an F_m-type fact, that indeed no F_a-type fact is a constituent of F_c. They hold instead that F_c is like F_a: F_c consists of entities somehow connected.

The dispute regarding how to analyse F_c is rooted in a difference of perspectives. Those who hold that F_c-type facts are basically like F_m-type facts focus on that which makes true a general statement. They reflect primarily on speech situations of the sort imagined above and are thus persuaded that there are, so to speak, only the marbles in the bag, only F_a-type facts.

Those that hold that F_c is not at all like an F_m-type fact focus, at least implicitly, on situations in which communication takes place and are thus persuaded that a molecular statement cannot in and of itself convey or communicate what a general statement does. General statements are not eliminable; they cannot be paraphrased as mere conjunctions. (I here assume that those who focus on a communication situation insist that no F_a-type fact figures in the analysis of an F_g-type fact. I also assume that only contingent general statements are relevant to the issue.)

There are, of course, other considerations that play a role in the dispute. For example, if one is intent on accounting for valid inferences one will be tempted to hold that an F_g-type fact is basically an F_m-type fact. Indeed, the simple versions of the so-called instantiation rules implicitly construe general statements as conjunctions. Be that as it may, those who insist that *there are* general facts are moved primarily by considerations concerning communication or meaning; those who deny that *there are* general facts, by considerations concerning 'what there is' in a speech situation to make true a general statement.

The use of '*there are*' indicates a difference between 'there are general facts' and '*there are* general facts'. The former expresses merely that some general statements are true; the latter, that F_g-type facts are not analysable into only F_a-type facts or, more precisely, that F_g-type facts are like F_a-type facts. Accordingly, '*there are* general facts' has a negative thrust: it signals a beginning, not an end. No one could hold that an F_g-type fact is *simple*, just as no one could hold that an F_a-type fact is simple.

Those who hold that *there are* general facts must thus specify the entities in an F_g-type fact and articulate how they are connected. No one has managed even to come close to doing that.

Those who have held that *there are* general facts have been empiricists and have thus accepted some version of the Principle of Acquaintance, a methodological principle to the effect that an entity cannot be granted ontological status unless it is something with which one is acquainted.

Consider again F_g, and assume that it is like an F_a-type fact. One can perhaps plausibly claim that one is acquainted with correlates for 'marble', 'red', and even 'in', but what of a correlate for 'all'? Moreover, even if it were plausible to claim that one is acquainted with a correlate for 'all', one would have to articulate how it connects or is connected with the other entities that figure in the analysis of F_g (when construed as like an F_a-type fact).

The only philosopher I know of who has tried to show that one is acquainted with a correlate for 'all' is Gustav Bergmann. His line of thought is short and simple. Consider a circle in which there is only one red square, and allow that the circle can be 'taken in at a glance'. Upon looking at the circle, one

immediately knows that all the squares in the circle are red. One is thus acquainted with a correlate for 'all'.

Bergmann's line of thought suffers from a long-standing confusion regarding the Principle of Acquaintance. There is a deep difference between immediately knowing that a contingent general statement is true and being acquainted with the entities that figure in the analysis of such a fact. Indeed, Bergmann's line of thought terminates merely in the claim that there are general facts. It does not even support the claim that *there are* general facts, let alone the claim that one is acquainted with a correlate for 'all'.

Those who have held that F_g-type facts are basically F_m-type facts have fared no better than those who have held that F_g-type facts are like F_a-type facts, for the former have tried to use a formalism or an artificial language to 'describe' the truth makers. They have thus been driven to maintain, as did the early Wittgenstein, that the difference between a mere conjunction and a conjunction that makes true a contingent generality 'shows itself'. They delude themselves. In order for a formalism to *show* rather than *say* something, there must be a feature of a sign, instead of a sign, that does representational work. For example, one can claim that the difference between particularity and universality shows itself, for one can allow the type difference between signs to do work; but no such feature is available to distinguish between only some objects in a container being of a certain kind and all objects in a container being of a certain kind.

I do not mean to imply that no defence of the claim that *there are* no general facts is possible; I mean to say merely that the defences thus far given ultimately rest on a claim to the effect that *all* shows itself and that such defences cannot withstand scrutiny.

I turn now to the attempt to discredit the problem. The most thoroughgoing attempt is the later Wittgenstein's. He challenges the make-true assumption, and does so in a sweeping way: *No kinds of statement have truth makers.* (Ryle, I should say, attempts to discredit the problems in a less sweeping way by denying merely that general statements have truth makers. According to Ryle, contingent generalities should be classified as 'inference tickets' or 'inference rules'. Ryle's attempt is thus limited in the way the positivist's attempt to discredit the ontological problem of ethics is limited: ethical statements do not *really* state facts, rather they express emotions.)

The later Wittgenstein's attempt is handicapped by his effort to fashion a 'new grammar', one relative to which none of the classical ontological problems can arise. That effort, even if successful, would not establish that the 'old grammar' is mistaken. The effort would establish, at most, that there is a way of talking that does not give rise to the problems addressed by the analytical ontologists. Furthermore, even if one could show that the make-true assumption is mistaken, one would still have to acknowledge that some ontological problems remain in place. For example, that there are things which share features in the sense that such things 'fall naturally' into groups or classes, is independent of all assumptions regarding how 'language works'; and that fact gives rise to a problem of universals. That one can devise a way of talking such that the problem cannot be expressed in the traditional way is of only passing interest, at best.

One must also acknowledge that there are cases in which all, rather than only some, objects in a container have the same feature; and that, too, is independent of assumptions about how language works. Such a situation gives rise to a problem similar to the problem of general facts as stated at the outset. Again, to devise a way of talking around it is of no enduring significance.

Ontological problems are still very much alive. What is dead are the myriad attempts to solve them by talking about formalisms and artificial languages, or to dissolve them by devising ways of talking around them. The so-called linguistic turn has turned out to be one more glorious failure in the history of ontology.

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Generics, Generic Objects

The notion of generic objects has evolved in the course of attempts by logicians, linguists, and philosophers to specify the logical semantics of so-called generic statements. Ontologically, the notion of generic objects is related to the notion of a kind, to the type-token distinction, and to the class-instance distinction that is customarily employed in the field of artificial intelligence.

Generic statements generally are considered to comprise the following sorts of linguistic phenomena:

Singular definite noun phrases:
(1) *The horse* occasionally mates with *the donkey*.
Plural definite noun phrases:
(2) *The horses* have a flowing mane and tail.
Singular indefinite noun phrases:
(3) *A horse* occasionally mates with *a donkey*.
Plural indefinite noun phrases (bare plurals):
(4) *Horses* occasionally mate with *donkeys*.
Mass terms:
(5) *Gold* is a precious metal.
Quantified noun phrases:
(6) Noah saved *all animals* in his ark.

The inclusion of mass terms in this list is justified on the basis of the intuition that both generic noun phrases involving count nouns (including quantified noun phrases) and generic noun phrases involving mass nouns may involve a reference to certain (natural or nominal) kinds. Independent of such semantic intuitions, syntactico-semantic tests for verifying a generic reading of bare plurals (Carlson, *Reference to Kinds in English*, 1978) and generic descriptions (Heyer 1987) have been proposed.

Although the notion of generic reference expresses a natural intuition, it needs to be noted that generic expressions do not constitute a semantically homogeneous group. There appear to be two basic aspects of generic reference, one related to *reference to kinds* and the other to *default reference*. In general, generic expressions involving default reference – called default generics for short – allow for the following substitution:

> If, in a sentence of the form '*F*(the *N*)', where the sentential predicate does not require a collective reading, 'the *N*' is a singular or plural generic expression, then so is 'a *N*' (assuming a corresponding change with respect to number of the respective noun when necessary).

Generic expressions involving reference to kinds – henceforth called kind generics for short – do not in general allow for this substitution.

Examples:

Kind generics:
(7) *The horse* came to America with the early Spanish explorers.
(8) *Dinosaurs* are extinct.

Default generics:
(9) *A mammal* suckles its young.
(10) *The Scotsman* drinks whisky.

It is to be noted that this distinction between kind generics and default generics not only applies to bare plural constructions as in (8), but also to definite generic noun phrases as in (7) and (10). The proposed distinction therefore does not simply correspond to the distinction between definite and indefinite generic noun phrases, but has to do with the logic of generic expressions in general.

It has been argued by Carlson (1982), Krifka (1987), and others that default generics need to be treated in essentially the same way as habitual sentences, e.g.

(11) John smokes.

The basic argument draws on the fact that default generics can be related to sentences containing quantificational adverbs, exactly as in the case of habitual sentences, as is illustrated by the following examples:

(12) Trouts reach a length of 30 cm.
(12') Trouts *occasionally* reach a length of 30 cm.
(13) John plays the violin.
(13') John *occasionally* plays the violin.

The claim is that default generics serve to record or assert the generality of certain *cases*; the semantics of a generic sentence are then thought to contain an adverb of quantification, and it is in the function of that quantificational adverb that the genericness of that sentence is to be located.

Evidently, this proposal does not work for kind generics, where a generalizing adverb of quantification is clearly inappropiate, as is exemplified by (14) and (15):

(14) ? *Man* always/often/usually/rarely/never set foot on the moon in 1969.
(15) ? *The lion* always/often/usually/rarely/never is a species.

It is not surprising, therefore, that nobody has proposed that one treat kind generics on the basis of a quantification over events or cases.

In consequence, we have a choice of either giving up a unified analysis of the generic readings of singular definite noun phrases, perhaps thereby gaining a unified analysis of default generics and habituals; or of insisting on a unified analysis of the generic readings of singular definite noun phrases (and bare plural noun phrases for that matter), and perhaps ruling out thereby a unified analysis of default generics and habituals. This choice is particularly relevant to the treatment of mixed kind and default generic readings as is exemplified by (16):

(16) *The dodo* lived in Mauritius and *it* became extinct in the 18th century.

On the first alternative, the reference of the definite generic noun phrase 'the dodo' of the first conjunct and the anaphor 'it' of the second conjunct cannot be the same, while on the second alternative both expressions would be analysed as referring to the same referent. The introduction of generic objects is crucial to this second alternative.

By way of conclusion we sketch the theory of generic descriptions elaborated in Heyer (1987).

We start with the assumption that generic descriptions refer to generic individuals. Thus, a description refers individually if it denotes an individual object, while it refers generically if it denotes a generic individual. The argument draws on the fact that, first generic descriptions behave syntactically like proper names, and, second, that attempts to treat generic descriptions as non-denoting expressions are unable to explain certain phenomena relating to kind generics and their behaviour with respect to anaphora. Once a description is interpreted generically, it then depends on the sentential predicate whether the description has a kind generic or default generic reading.

The notion of generic individuals is to be taken as derived from the notion of a *type* (Zemach, *Journal of Philosophy*, 1970). Types have no parts in either dimension, space or time. Types have *representatives*, but these representatives are not parts. Thus, a single dog is not a spatial part of the type dog, as e.g., the right foreleg is a spatial part of a particular object dog. Types can be said to change or not to change, but it is always the *whole* entity that needs to be considered as changed (or unchanged). Thus, the type dog is recurrent as a whole in space and time in the same sense that a single dog is recurrent as a whole with respect to time. Now, generic individuals are restricted to countable objects that can be assumed to be hierarchically ordered such that lower types *represent*, or exemplify, higher types.

Generic individuals are thought to have two kinds of properties. On the one hand, they have properties that apply only to *them*, i.e. kind-level predicates like 'is widespread' and event predicates like 'was imported into Europe in 1906'. On the other hand, they also

have distributional properties that determine certain properties of their representatives *qua representatives* like 'barks' or 'suckles its young'; these can be called dispositional properties.

Kind reference of a generic description is then explained as reference to a generic individual in the context of a kind-level predicate (e.g. '*The mammal* is widespread'). Default reference of a generic description is explained on the basis of kind reference in the context of a disposition (e.g. '*The mammal* suckles its young'). The idea is that representatives of a kind have certain dispositional properties *because* they are representatives of that kind (e.g. an individual female mammal can suckle its young because it is a mammal), and, vice versa, that the characteristics of a kind determine which dispositional properties the individual representatives of a kind can have.

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GERHARD HEYER

Genidentity

The paradoxical statement of Heraclitus: "We step and do not step into the same river", points out that a changing object can be conceived of as a sequence of non-identical states. Now the question arises in which way states at different times are reckoned as belonging to the same object. The modern answer is that two different states belong to the history of the same object if they are genidentical.

In contrast to Heraclitus, Plato focused his attention on strict identity and was worried by the profound Heraclitean reflections on genidentity. According to the fundamental conception of Plato's theory of Ideas, certain general expressions of colloquial language denote unique abstract objects distinct from human thoughts. Without such abstract Ideas there could be no mathematical or scientific knowledge, for even Plato accepted the Heraclitean doctrine that all sensible things are always in flux, and he was convinced that there is no knowledge of such things (cf. Aristotle's *Met.* 1078b13–17).

In modern philosophy of nature the Heraclitean problem can be handled in an exact manner by generalizing the relation of strict identity. Modern physics studies movements and coincidences of particles. Moments of particles are called '*world points*'. If two world points touch, they are said to coincide. The relation of *coincidence* is symmetric and transitive and hence an equivalence relation. Furthermore, it must be postulated that each world point belongs to the field of this relation. A local time order (*Eigenzeit*) is established by introducing a topological notion of being *earlier than*. This relation between world points is transitive and irreflexive and included in the complement of coincidence.

World points are *genidentical* if and only if they are strictly identical or if the local time relation holds between them in either direction. Genidentity is an equivalence relation and therefore groups all world points into equivalence classes. The *world lines* are the non-empty equivalence classes of the relation of genidentity. Hence, a world line is the set of all world points which are genidentical with some world point. A world line never ramifies into the past or the future. For continuous world lines a metric can be introduced which correlates world points to real numbers.

All empirical qualifications of physics can be reduced to determinations of coincidence and local time relationships among genidentical world points. Furthermore, by defining a causal signal relation and the notion of simultaneity, the concepts of space and time and the topological properties of space can be constructed on the basis of coincidence and local time order.

The term '*genidentity*' was introduced in 1922 by Kurt Lewin for three different relations between physical objects, biological organisms, and individuals of genealogical trees, respectively. The term was adopted for

a relation between world points by Reichenbach (1928) and Carnap (1929) in their analyses of the topology of time and space.

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JAN BERG

Genus. See: Species, Genus

Geometry

Issuing from the Sumero-Egyptian art of land surveying (Greek γεωμετρέω), geometry grew in Greece as the demonstrative science of plane and solid figures constructible with ruler and compass. Its foundation was attributed to Thales of Miletus (fl. *c.* 580 BC), also the legendary father of philosophy. Greek geometry and philosophy interacted strongly. Geometrical proof set standards of rigour for philosophical argument. The Eleatic School of philosophy supplied the geometers with the earliest examples of demonstration by *reductio ad absurdum*. The drastic idealizations of geometry – widthless lines, depthless planes, changeless figures – and their relation to sand drawings and wooden models inspired and documented Plato's doctrine of the immutable Forms, 'imitated' by the things that surround us and constitutive of their being. Plato, in turn, by stressing that genuine science (ἐπιστήμη) cannot take anything for granted, but should seek to account for everything by "going right up to the principle of the universe" (ἐπι την τοῦ παντός ἀρχήν ἰών, *Rep.* VI.511b), helped to motivate the organization of geometric lore into long chains of reasons, nailed to a few unimpeachable axioms. Decades before its classical formulation in Euclid's *Elements* (*c.* 300 BC), Greek axiomatic geometry had provided the paradigm for Aristotle's idea of a demonstrative science, or ἐπιστήμη properly so-called, as expounded in the *Posterior Analytics*. In such a science, every statement must only employ words definable from a given list of terms that need no explanation, and must be deducible from a given list of assertions that need no proof. The latter express the principles of a particular domain of being, studied by the science in question; but not, indeed, the principle of everything, as in Plato's dream. Though notoriously alien to Aristotle's own scientific practice, and only imperfectly realized in Euclid's book (Postulate V is not self-evident, Pr. I, Book I does not follow from the stated axioms, etc.), this Aristotelian idea of ἐπιστήμη has weighed heavily on Western science and philosophy.

Driven by its own internal demands, as witnessed by Euclid's quest for *loci*, i.e. sets of points satisfying some specified condition, the science of figures unwittingly became the science of space – regarded as a repository of all conceivable sets of points – and of the necessary relations of neighbourhood, collinearity, and distance between such points. In this guise we meet it in René Descartes's *Geométrie* (1637), proffered as an illustration of the philosopher's new method for the advancement of knowledge, and rightly regarded as the first treatise of modern mathematics. Descartes also identified space with the substance of material things, thus furnishing an ontological justification for Johannes Kepler's (1571–1630) dictum that 'God always geometrizes', for Galileo's claim that 'triangles, circles and other geometrical figures' are the alphabet in which the book of nature is written, and generally for the modern programme of natural philosophy built on mathematical principles.

The geometry of Euclid and Descartes was too narrowly conceived for this programme to advance without resorting to ungeometrical ideas, such as Newton's 'impressed force'. But the luxuriant flowering of geometry in the 19th century created the means for a thoroughly geometrical representation of physical phenomena, as illustrated by the now prevalent gauge theories of fundamental

interactions. The chief novelties are named and sketched in barest outline in the following list.

Geometric Pluralism. The points of space – of 'a' space – can be conceived as sustaining altogether different systems of neighbourhood, collinearity, and distance relations. Two research programmes did much to bring about this insight:

1. the study of collinearity without regard to distance in projective geometry, and
2. the unsuccessful attempts to prove Euclid's Postulate V, culminating in the independent publication by Nikolai Ivanovich Lobachevski (1828–30) and Farkas Bolyai (1832) of consistent deductive systems based on its negation.

Felix Klein (1849–1925) showed in 1871 how three different systems of distance relations, entailing that the sum of the three angles of a triangle is $= \pi$ (Euclid), $< \pi$ (Lobachevski–Bolyai) or $> \pi$ (Klein's 'elliptic' geometry), can be alternatively imposed on a point system aligned by the laws of projective geometry.

Transformation Groups. Partly prompted by this success, Klein (1872) proposed a grand scheme for classifying the burgeoning fauna of geometries. Take ordinary Euclidian geometry, and let S denote its underlying space of points. Consider the collection T of all transformations of S ($t \in T \Leftrightarrow t$ maps S one-to-one onto itself). Since two successive transformations yield a single (composite) transformation and any transformation can be followed by another (inverse) transformation that annuls it, T constitutes a *group*, in the strict algebraic sense. An arbitrary $t \in T$ generally wreaks havoc with the geometric relations between the points of S; but different subgroups of T preserve, e.g., the neighbourhood system but not the straight lines, or the latter, but not the distances, or, finally, all three kinds of relations. Every such subgroup has its own peculiar algebraic structure. Klein proposes to define each geometry by the transformation group that preserves its characteristic relations. If G_1, G_2, and G_3 are geometries respectively determined by groups Γ_1, Γ_2, and Γ_3, G_2 and G_3 are plainly subgeometries of G_1 if Γ_2 and Γ_3 are subgroups of Γ_1. The seemingly antagonistic geometries of Euclid and Lobachevski are thus reconciled: they study the invariants of different subgroups of the projective group, and, as Jules Henri Poincaré (1854–1912) noted in 1887, 'the existence of a group is not incompatible with that of another'. In Hermann Minkowski's (1864–1909) geometrical formulation of Albert Einstein's (1879–1955) special relativity, invariance under the theory's characteristic group becomes the mark of physical objectivity.

Manifolds. The modern idea of a manifold – specifically, of a *differentiable* manifold – can be traced to Georg Friedrich Bernhard Riemann's (1826–66) lecture *Über die Hypothesen, welche der Geometrie zugrunde liegen* (1854, published 1867). Subsequently elaborated by Gregorio Ricci (1853–1925), Tullio Levi-Cività (1873–1941), Elie Cartan (1869–1951), Hermann Weyl (1885–1955), Roger Penrose (born 1931), etc., this concept remains unmatched as a vehicle for the mathematical representation of nature. It cannot be properly explained here. The books by Schutz and Choquet-Bruhat *et al.* mentioned below can assist the reader in understanding its power and its beauty.

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ROBERTO TORRETTI

Gerson. See: **John Gerson**

Gestalt

After a period of neglect, Gestalt theory is now once more attracting scientific and philosophical interest (see Kubovy and Pomeranz 1981, which gives a survey of Gestalt-oriented concepts still active in current psychology; Beck 1982; Smith 1988, which includes an extensive bibliography; and Kanizsa and Caramelli 1988). If we examine university textbooks on vision and perception we see that the empirical discoveries of Gestalt psychology are considered a secure part of our knowledge in this field. Nevertheless, classical Gestalt theory remains known only through its association with a few key terms such as: 'phenomenological method', 'anti-elementarism', 'anti-associationism', 'isomorphism', 'field theory', '*Prägnanz*', etc. These terms are principally connected with the names of Max Wertheimer (1880–1943), Kurt Koffka (1886–1941), and Wolfgang Köhler (1887–1967), who were leading figures of just one of the Gestalt-oriented schools at the beginning of the century. Today only a few psychologists would accept a strict Gestalt-oriented programme of the sort that has been pursued by such direct heirs of classical Gestalt theory as Wolfgang Metzger (1899–1985), Edwin Rausch (b. 1906), Cesare Ludovico Musatti (1897–1989), Gaetano Kanizsa (b. 1913), Fabio Metelli (1907–87), Gunnar Johansson (b. 1911), and their students. More precisely, we could say that, in contemporary psychology, certain general features of the Gestalt approach are still present but that they are not central to current work.

The Emergence and Development of the Notion of Gestalt. If we ignore certain possible predecessors such as Goethe (1749–1832), Jan Evangelista Purkinje (1787–1869), and Ewald Hering (1834–1918), the first scientist and philosopher directly to influence the development of Gestaltism was Ernst Mach (1838–1916). For Mach, in his *The Analysis of Sensations* of 1886, sensations alone are real, while all 'complexes' are ideal, i.e. they are mental units which contribute to the 'economy of thought' but correspond to nothing in reality. In criticizing Johann Friedrich Herbart's theory of complexes, however, Mach raises two intriguing questions which were to become fundamental to the development of Gestalt psychology:

1. How can we determine that two figures *A* and *B*, for example a white square and a black one, differing in position and colour, are the *same figure*?
2. If we play a melody first in the key of C on a trumpet and then in the key of F on a violin, how does the hearer recognize that it is the *same melody*?

According to Mach, we can recognize the identity between *A* and *B* because the corresponding 'muscular sensations' (*Muskelempfindungen*) associated with the motor processes of the eye and head are qualitatively the same. For this account to work in the case of the melody, we must hypothesize that such *Empfindungen* have a temporal extension and that also memory processes are involved.

In 1890, Christian von Ehrenfels (1859–1932) reformulated Mach's problem in terms derived from a theory of whole and parts. A melody *G*, he argued, is qualitatively different from the sequence of tones $e_1, e_2, \ldots e_n$, of which it is composed. This is because:

1. We can change the components of a melody, e.g. by transposing it, and leave the melody unchanged.
2. We can remember a melody directly, i.e. without necessarily remembering its tones.

In Ehrenfels's paper these two points serve as criteria for individuating a class of perceptual entities which he names *Gestaltqualitäten*. Further, he states that such entities are *de facto* objects of direct experience. But he leaves open whether they are the result of an active and partially voluntary perceptual process or a passive and automatic one.

Historically, Ehrenfels's paper set in train a veritable explosion of theoretical debate and experimental work in which the most representative psychologists of the period participated (see Ash 1982). Here the contributions of the so-called Graz and Berlin Schools are the most important.

The Graz School. In the Graz School, to which Ehrenfels was close, the Mach–Ehrenfels problem is divided into two parts:

1. What is the *ontological* relationship between a Gestalt and its components?
2. What is the *psychological* process which is involved in the perception of a Gestalt?

The theory of objects or '*Gegenstandstheorie*' of Ehrenfels's teacher Alexius Meinong tries to solve the first part of the problem. What place does a Gestalt have among the objects of our experience? A Gestalt is an object of a type distinct from things and facts; in Meinong's terminology it is an "object of higher order" which has the objectual character typical of the elements which underlie it but which does not exist in the same sense as they do, because it stands to them in a relation of existential dependence or foundation (*Fundierung*).

The *Produktionstheorie*, developed in particular by Meinong's student Stephan Witasek (1870–1915), tries to solve the psychological part of the problem. The perceptual process underlying the experience of a Gestalt must, he argues, reflect the objectual structure of that Gestalt. The existence of a Gestalt depends on the elementary sensations of which it is composed, but its character as a *Gestalt* is something new, which must be 'produced' by the mind on the basis of these sensations. Production, for the Meinongians, operates exactly like perception: we can say, with Meinong, that production *is* the perception of Gestalten. For Meinong, perception combines the two elements of sensory presentation (*Vorstellung*) of the object perceived and a judgement of existence of this object. The latter is an act of thinking. Production is like perception in that there is judgement-like activity of the mind involved in both. In the one case it determines the status of the object as existent, and in the other as a produced Gestalt.

Vittorio Benussi (1878–1927), the leading experimental psychologist of the Graz School, tried to confirm empirically Meinong's theories of Gestalt perception. Benussi's original contribution is the theory of the sensory and non-sensory inadequacies of perception. Sensory inadequacies arise in virtue of certain peculiarities of physical stimuli and peripheral sensory processes. Consider, e.g., the chromatic contrast: two grey surfaces which are equal in reflectance and luminance do not appear equally bright if they are placed one on a black background and the other on a white background. Non-sensory inadequacies arise in virtue of the fact that there are perceptual patterns which are ambiguous (*mehrdeutig*) even if all physical and physiological information remains constant. Consider, e.g. the Necker cube. The light reflected by the configuration of lines which we designate as 'Necker cube' (the physical or distal stimulus) contains always the same information and the energy which excites the sensory system (the physiological or proximal stimulus) may be supposed to be the same. Yet we perceive always one of *two* possible objects: a cube with the lower face in foreground or a cube with the upper face in foreground. In such cases the observer can often decide what he wants to perceive among a number of alternatives. Benussi concludes that we must postulate the existence of some central process of elaboration or gestaltification of the data given in sensation. A perceived Gestalt is a typical example of such a non-sensory presentation. Benussi's theory coincides largely with the original *Produktionstheorie* of Meinong and Witasek. Meinong and Benussi differ, however, in their views on perception. For Benussi, perception is a presentational phenomenon in which inferential activity or judgement is completely lacking.

After World War I the Graz School practically disappeared. Benussi moved to Padua, where he inaugurated an Italian tradition in experimental psychology continued by Cesare Ludovico Musatti, Fabio Metelli, and Gaetano Kanizsa. Kanizsa, especially, has produced contributions to Gestalt studies still important today (e.g., see his *Perceptual Organization* of 1979).

The Berlin School. In 1910 Wertheimer, a student of Ehrenfels in Prague and of Carl Stumpf in Berlin, carried out studies on movement perception which can be regarded as the starting-point of the Berlin School. The

study of movement perception is crucial to the solution of the Mach–Ehrenfels problem. The events constituted by movements of objects in three-dimensional space are, in fact, that sort of spatio-temporal Gestalten which forms the greatest part of our perceptual experience. Wertheimer focused his attention on the so-called '*phi* phenomenon', an apparent movement obtained when two identical visual stimuli at different points in space are presented successively. If the distance between the two stimuli and the rhythm of succession meet certain conditions, the stimuli will appear as one moving object which jumps from one position to the other. Such apparent movement was observed for the first time in the 19th century by Joseph Plateau (1801–83) in 1850 and then studied by Sigmund Exner (1846–1926), one of Wertheimer's teachers in Prague, in 1875. Two traditional theories have been put forward to explain it. According to Hermann von Helmholtz (1821–94), my perception of a moving body is the result of an inference of my perceptual system with respect to the different discrete spatio-temporal states that the body has assumed during the movement. It is for this reason that the *phi* phenomenon is usually interpreted as movement by our perceptual system. According to Exner, apparent movement is a sensation (*Empfindung*), i.e. something we experience immediately, something which it is impossible to decompose or analyse further into elementary components.

The position of Wertheimer and of the Berlin School as far as movement perception is concerned is in the Exner tradition, except that Wertheimer postulates a neurophysiological theory of 'short circuits' or 'transversal functions' in the cortex as constituting a possible biological basis of the *phi* phenomenon. The position of the Graz School, on the contrary, is often identified as a theory belonging to the Helmholtz tradition.

In 1913, Köhler wrote a critique of what he called the 'constancy hypothesis' (*Konstanzannahme*), a doctrine accepted by Helmholtz and Stumpf which assumes a one-to-one correspondence between stimuli and sensations. When we find a mismatch between the physical level and the perceptual level we can still retain such a 'constancy' between stimulus and sensation if we assume the intervention of 'unconscious inference' or 'unobserved processes' which explain the mismatch. Consider, for example, the illusory contours in the Kanizsa triangle. We perceive a contour which has no physical existence. Therefore, we lose the correspondence between stimuli and sensations. But, given a certain disposition of lines and coloured surfaces, our cognitive system is, as Helmholtz sees it, forced to infer the presence of a triangle and to 'invent' some non-existent contours. From the gestaltist perspective, however, these are *ad hoc* hypotheses designed to prop up traditional elementarism.

In 1915 Koffka utilized Köhler's arguments against the constancy hypothesis in a debate with Benussi. Koffka criticized Benussi's distinction between sensory and non-sensory presentations. There are, Koffka argues, no reliable criteria to distinguish them. In both cases, he argued, there is the same concrete perceptual relationship with an environment in which nothing other than Gestalten are perceived, and perceived directly. The problem with the *Produktionstheorie* is that it implicitly assumes the constancy hypothesis and holds that we first have sensations which stand in a one-to-one correspondence with stimuli. We then combine them into a Gestalt by means of inference-like central processes.

Koffka rejects this view. But the target of Koffka's critique is strictly Meinong's position, which only partially coincides with that of Benussi. The sole real contrast between Koffka and Benussi concerns the conception of the stimulus. For Benussi the latter is a flux of energy which contains potential information concerning the environment. But, in order to use such information, the stimulus is decomposed at the peripheral level and then restored at the central level. For Koffka the stimulus is a set of organized information found and used as such by the organism without any necessary previous decomposition. As Koffka writes in his *Principles of Gestalt Psychology* of 1935, *each thing says what it is*: "a fruit says 'Eat me'; water says 'Drink me'; thunder says 'Fear me'; and woman says 'Love me'" (p. 7).

Koffka's account of stimulus forms the basis of the final step in the Gestalt theory of

the Berlin School, first set out in Köhler's book *Die physischen Gestalten in Ruhe und im stationären Zustand* of 1920. Köhler developed the new conception of stimulus as part of a defence of the programmatic thesis of psychophysical isomorphism, i.e. the hypothesis of a structural correspondence between perceptual experience and the underlying physiology of corresponding brain processes.

The hypothesis was suggested by the discovery that there are physical phenomena which present all the characteristics typical of the Gestalten. Köhler did not, be it noted, assert that the relationship between perceptual experience and the physical world is isomorphic. It is clear that human perception contains many phenomena the like of which never occur in the physical world. What he had in mind is that there are certain 'structural properties' of Gestalten which are independent of the psychological, physiological, or physical matter which makes them up and which can occur on all these three different levels (see his *The Task of Gestalt Psychology* of 1969). The next step is to discover and accurately describe these structural properties, and this brings the Gestaltists to develop the electric field analogy which leads in turn to an account of the 'laws' of perceptual organization.

Consider, for example, the following two laws of grouping. The sequence of letters *ppqqppqq* is seen as four groups *pp, qq, pp, qq*, because of similarity. However, the sequence *qpqpqpqp*, which consists of the same letters, is divided in four groups of *qp* because of symmetry, which is here more striking than similarity. The gestaltist concept of *Prägnanz* integrates the notions of regularity, simplicity, and symmetry and gives, as a sort of meta-principle, the path to find and to interpret the single specific laws. The field analogy is an attempt to clarify the same notion: each psychological phenomenon must be considered as a part of a whole of coexistent and interdependent facts. As the behaviour of a single charge in an electric field is determined by the forces which are exerted by all other electric charges, similarly the manifestation of any given psychological process is a function of its entire psychological field. A psychological phenomenon can exhibit some local regularities such as symmetry or similarity, but the quest for the global regularities of its field remains the most economical and adequate description which we can give of it.

Recent Developments. The subsequent development of Gestalt theory is characterized on one hand by a period of systematization and vulgarization and on the other hand by remarkable experimental work on certain specific subjects of interest for Gestalt theory: see for instance the studies by Wolfgang Metzger on the 'total field' (*Ganzfeld*), the studies of Albert Edward Michotte (1881–1965) and his school on the perception of causality, and the studies by Gunnar Johansson (1950–) on the perception of events.

Among the theoretical contributions, the work of Edwin Rausch represents a sort of conclusion. Rausch reconsiders the position of the Graz and Berlin Schools and tries to reconcile the two different views in order to reconstitute Gestalt theory as a descriptive science. For the Berlin School, Gestalten are 'a special kind of whole'. For the Graz School, the Gestalt is a quality or an 'attribute' of an aggregate or complex of elements. Rausch, however, points out that it is always possible to give two descriptions of an object or an event, first as a whole in which its parts are only potentially discriminable, and second as a quality of separate parts, a quality which, in our perception of this object, can assume different degrees of intensity. The choice of descriptive level depends on the concrete relationship between the perceiving organism and its environment. For example, to answer the question 'What time is it?', I need to see my watch. The concrete relationship between me and my watch, characterized by my intention to know the time, determines what I see. In fact, it can be difficult to remember the shape of the digits (e.g. on seeing a strange watch), even after using them to satisfy my desire to know the time. I saw the digits, but only as a part of the Gestalt 'watch'. If, however, my intention had been to know the shape of digits, I would have seen a particular set of separate digits, which, together with other

components, would have the quality of being a watch.

Direct and Indirect Perception. 'What do we immediately perceive?' This is a classical philosophical question which arises in connection with the distinction between primary and secondary qualities. The Helmholtz inferential theory of perception and later the Moore–Russell causal theory of perception tried to systematize this initial distinction. In Bertrand Russell's *The Analysis of Matter* (1927), the causal theory of perception has two parts:

1. perception does not give direct knowledge of external objects;
2. there are external causes from which perceived objects can be inferred.

According to this theory we have a direct perception of 'sense data' and an indirect one of the objects which are inferred from them.

In the psychology of perception there is a specific version of the causal theory known as 'cue theory'. A 'cue' is an aspect of the perceptual world (such as indices of depth or the disposition of objects in space) which is associated by learning with some features of the physical world. All such theories belong to the Helmholtz tradition.

J. J. Gibson (1904–79) criticized such approaches to perception in his *The Senses Considered as Perceptual System* of 1966 and *The Ecological Approach to Visual Perception* of 1979. For Gibson, inspired in this respect by Koffka, we have a direct perception of reality: "what the observer perceives is a success, an achievement" (see Katz, 1987, p. 541). We have, in fact, direct access to salient features or 'affordances' of the environment which permit us appropriately to modulate our behaviour.

This antagonism of direct versus indirect perception can be considered as a new version of the core of the Ehrenfels–Mach Gestalt problem. Consider the following points, which we can regard as the currently valid legacy of the classical debate:

1. *The terminological level.* Talk of perceptual 'error' or 'illusion' is incorrect. While the result of a cognitive process, e.g. a simple arithmetical calculation, can be true or false, the result of a perceptual process cannot, even if we know that it does not correspond to physical reality, for the trivial reason that we *experience* it. If I observe the well-known figure of Brentano–Müller–Lyer, I *know* that the two main lines are equal, but I *see* that they are of different length. My knowledge of the physical layout of the lines has no influence on my perception; the latter can be inadequate to know the physical reality. Paradoxically, perception is always an 'achievement', while cognition ought to be, even if it is not always the case because of our fallacy or incapacity to develop appropriate inferences. The consequence on the theoretical level is that seeing and thinking are functionally distinct (see J. Fodor, *The Modularity of Mind*, 1983).

2. *The physiological level.* Here the positions of the two schools are different. For Benussi the fact that perception is always an achievement sets no limits to possible neurophysiologically-oriented explications about how perceptual processes operate. For the Berlin School this fact corroborates a direct theory of perception, and this in turn suggests a specific direction for neurophysiological investigation (the hypothesis of isomorphism).

3. *The phenomenological level.* Our experience of Gestalten and their elements induces us to study the relation which exists between a whole and its parts. The Graz School interprets such a relation as a dependence of the whole on its parts. This represents the basis for a more general functional description of mental events as constituting a hierarchy of levels, the relations between which are expressed in terms of dependence. The Berlin School refrains from specifying the exact nature of this relation and hereby commits itself to a more radical conception of stimulus: we perceive nothing but Gestalten, i.e. the same principles of organization operate across the whole diversity of our experience.

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NATALE STUCCHI

Gestalt Linguistics

The scientific concept of Gestalt was proposed by Christian von Ehrenfels (1859–1932) in 1890 in his article "On Gestalt qualities" (translated in Smith 1988). His proposal was that:

> wherever we have a relation . . . between a complex of experienced elements on the one hand and some associated unitary experience of a single invariant structure on the other, we are to conceive this latter structure as a Gestalt (Smith 1988, p. 14).

In the Berlin School of Gestalt psychology the term 'Gestalt' was applied to physical (physiological) *and* phenomenological (psychological) wholes. Both levels are linked by laws of *isomorphism*. Kurt Lewin expanded the principles of Gestalt psychology to social psychology. In the classical era (1890 to 1945) linguistic applications refer to language perception or to emotional and social processes in communication.

Gestalt linguistics was developed independently by different authors in the 1970s. It applies the basic insights of Gestalt psychology to linguistics (phonetics, semantics, discourse linguistics). The basic topics and concerns are:

1. The morphological continuity between external (physical, biological) Gestalten and cognitive and linguistic Gestalten. Hence the basic invariants of mappings between the 'world', cognition and language are sought.
2. Linguistic levels and linguistic entities are stable Gestalten in self-organizing systems and constitute dynamic fields with internal autonomy.
3. The evolution and change of language is a process in space and time comparable to the temporal organization of biological and physico-chemical systems and obeys similar laws.

Gestalt linguistics is concerned with cognitive schemata, frames, procedures, their expression in language, and their possible neural correlates. Basic topics are natural categories found in linguistic behaviour and the search for models of the mind underlying linguistic categorization. Two complementary strategies in pursuit of this programme may be distinguished:

1. Phenomenological Gestalt linguistics. The empirical study of natural categories in a large survey of languages is used to infer cognitive Gestalten and to shape a plausible model of the human mind. Results of this strategy are summarized in Lakoff (1987).
2. Dynamic Gestalt linguistics. Starting with general features of dynamic, self-organizing systems in nature and recent advances in the theory of (non-linear) dynamic systems (catastrophe theory, bifurcation theory, synergetics, chaotic systems, and fractals), Gestalt linguistics proposes models and explanations for the emergence of natural categories and for natural mappings in semantics (the relation of external processes to grammatical configurations). This style was introduced by the French topologist René Thom in the 1960s and was applied to linguistics by Wolfgang Wildgen and Jean Petitot.

Recent developments point to a further co-ordination of Gestalt linguistics with the developments in cognitive linguistics and experimental psycholinguistics. The relevance of these efforts for advanced simulations of linguistic abilities on the one hand and for the philosophy of mind and language on the other hand is obvious.

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WOLFGANG WILDGEN

Geulincx, Arnold

Arnold Geulincx (born Antwerp 1624, died Leiden 1669) spent the first part of his academic career at Louvain; in 1658 he lost his post there and went to Leiden, where he taught logic and, mainly in private tutorials, other philosophical subjects. The principal sources for his metaphysics are three disputations of 1666 and 1669 (ed. Land, II, 469–88) and the posthumously published (1691) *Metaphysica vera, Metaphysica ad mentem Peripateticam*, and *Annotata ad Metaphysicam* (ed. Land, II, 139–98, 199–265, 266–310). Under the title *Geest- en Wereldkunde*, a Dutch translation of these writings saw the light in 1696. Already at Louvain Geulincx had openly criticized the traditional approach of the Peripatetics and made no secret of his sympathy for Descartes's philosophy. In the *Metaphysica vera* he expounds the Cartesian doctrine, in three parts: an autology about the thinking self, a somatology about bodies, and a theology about God. An original feature of Geulincx's system is the occasionalism by which he seeks to elucidate the relationship between mind and body. When, for instance, I want to say something and at the same time actually utter it, my mental acts of willing and the physical movements of my organs of speech are exactly concomitant, but without there being any dependence of a member of one series upon a member of the other series. It is God who arranges the phenomena in such a way that on the occasion of the occurrence of one member a corresponding member of the other series appears. Genuine metaphysics should concern itself with things as they are in themselves, in abstraction from the modes of thinking by which the mind conceives them and from the linguistic instruments by which such conceptual constructions are expressed. The Peripatetic metaphysicians, however, have succumbed to the common tendency to ascribe the modes of thinking contributed by the mind to things as they exist independently of any thought and language. Geulincx's elaboration of this point in the *Metaphysica ad mentem Peripateticam* foreshadows the Kantian revolution.

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GABRIEL NUCHELMANS

Gibson, J. J.

James J. Gibson (1904–79), an American psychologist, has been widely recognized for half a century for his innovative contributions to the study of perception. A student of the behaviourist Edwin B. Holt (1873–1946) at Princeton University, Gibson came to reject classical stimulus-response theory (see *The Perception of the Visual World*, Boston, 1950), but also vigorously opposed the reversion to mentalism characteristic of more recent cognitive psychology. Influenced by

the Gestalt psychologists (especially Kurt Koffka (1886–1941), his colleague at Smith College from 1929–41), Gibson advocated an 'ecological' theory of perception that involved sweeping changes in the conceptual foundations of psychology.

Against mentalists and materialists alike, Gibson held that it is impossible to distinguish the contribution of the perceiver from that of external stimuli when perceptual phenomena are examined at a level appropriate to psychology. Ecological theory accordingly begins with a redescription of perception as an embodied, ambulatory observer's *direct* awareness of an environment replete with '*affordances*' (Gibson's term for properties of the surrounding world related to a perceiver's intentions, needs, and bodily condition). In Gibson's view, an observer sees directly an edge too steep to step off; a surface sufficiently rigid and extended to sit on; fruit ripe enough to eat. Affordances are not 'meanings' or 'values' attached to bare physical or sensory qualities, but utilities of the environment and possibilities for action (i.e., reciprocal relational properties that link perceiver and environment). Due to the pressures of biological adaptation, perceptual systems have evolved to search for affordances, and accordingly cannot be conceived as mere "channels of sensory input" (see *The Senses Considered as Perceptual Systems*, Boston, 1966).

Gibson analysed the direct perception of affordances in his last work, *The Ecological Approach to Visual Perception* (Boston, 1979). The basis of the 'ecological optics' presented there is not the radiant energy of physics, but many-times reflected light that illuminates the environment. Light reflected from the surfaces of the surrounding world forms a unique "ambient optic array" at every place an observer might occupy. In so far as this complex and changing optical structure is in lawful correspondence with the physical layout of the environment, Gibson claimed that the optic array provides '*information*' specifying affordances. In this relational or specificational sense of the term, information (consisting of nested, geometrical projections) is *in the light*, not in the head. Ambient light does not transmit signals from the world to the mind-brain for decoding. It contains information that may be picked up by any attentive observer.

Perhaps the most radical consequence of the theory of optical information pick-up is that vision is no longer conceived as the conversion of a sequence of two-dimensional retinal images or forms into a three-dimensional scene. Visual perception typically involves movement, and since changes in the visible environment are registered as transformations of the optic array, Gibson argued that there must be characteristic *invariant* optical structures that specify different kinds of material properties and events. Sensory intuitions without concepts are *not* blind. Invariants must be picked up if affordances are seen, but they are not "added by the mind". In this way, Gibson's ecological ontology challenges traditional appeals to either innate forms of intuition or mechanisms of association to explain perceptual phenomena.

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DAVID BLINDER

Gilbert of Poitiers

Gilbert of Poitiers (*c.* 1075–1154) was a student of Hilary of Poitiers, Bernard of Chartres (died *c.* 1124), and of Anselm and Ralph of Laon. His surviving works are commentaries on Boethius's *Opuscula sacra*, on the Psalms, and on St. Paul's letters. All were written between 1115 and 1145.

Gilbert's work was controversial, especially his distinction between God, a subsistent, and Divinity, a subsistence. Like Peter Abelard, he confronted Bernard of Clairvaux (*c.* 1090–

1153) at the Council of Reims (in 1148), but unlike him escaped Bernard's attack by agreeing to sign a confession of faith and to change anything in his works which did not conform to it. No changes were made. Gilbert and his followers, the Porretani, were active in the great debates over logic and language which took place in Paris in the second half of the 12th century. The *Compendium Logicae Porretanum* (CLP) summarizes their views.

Theory. The distinction between subsistent (*subsistens*), or that which is (*id quod est*), and subsistence (*subsistentia*), or that in virtue of which it is (*id quo est*), is fundamental in Gilbert's philosophy. Consider the white, knowledgeable man, Socrates. He is one subsistent body in virtue of a singular subsistence, his corporality, one subsistent rational being in virtue of his rationality, and so on for the various *differentiae* of man. The forms corresponding to the terms in the definition of man are the subsistences in virtue of which he is a subsistent of a particular kind. In their concretion (*concretio*) together they constitute his humanity.

Associated with each substantial subsistence are accidents of quality and in bodies accidents of quantity. Such accidents inhere in Socrates because they adhere to the various subsistences in virtue of which he is a man. By an accident of body he is white and by an accident of rationality he is knowledgeable. Unity (*unitas*), or singularity (*singularitas*), and according to CLP truth (*veritas*), are forms accompanying each subsistence. Socrates is thus one true man in virtue of his humanity and its unity and truth. The plurality of unities does not yield a multiplicity of numerically distinct subsistents since the subsistent rational being and the subsistent body are numerically none other than Socrates.

In creating the world God brought into being only two everlasting forms, corporality and spirituality. There are always bodies and spirits but at different times they are different kinds of substances as different sets of *differentiae* are concreted together. Since each substantial subsistence brings with it accidents, the result of combining all the *differentiae* of a species with its *genus generalissimum* is an individual substance. An individual is thus constituted by the concretion of a maximally consistent set of subsistences and accidents called by Gilbert a total property and by CLP a plenitude (*plenitudo*) of properties. These terms must be regarded as primitive in the theory since Gilbert tells us only that a total property is the collection of forms by which an individual is actually or possibly dissimilar to all others. Without knowing how to identify a temporally extended individual, however, we will not be able to locate this set. Accidents belonging to the remaining seven categories determine the status or circumstances of a thing but not which individual it is.

Equally primitive is the relationship of sameness (*similitudo*) holding between proper subsets of distinct total properties. Socrates is white in virtue of his singular whiteness as is Plato in virtue of his, but they are the same in being white. The universal, whiteness, is the collection (*collectio*) of all subsistences in virtue of which something is white and this is neither subsistent nor subsistence. The notion of collection derives from Boethius's claim that understanding collects intelligible universals from sensible singulars. However, where for Boethius a collection was a mental operation resulting in the abstraction of an intensional entity, for the Porretani it is simply the set of all whitenesses. Their account of universals is thus a variety of collective anti-realism.

As important as the controversies over universals in the 12th century were arguments about the logic of the conditional. Abelard distinguished two conditions for the truth of such propositions. The weaker corresponds to our strict implication while the stronger requires that the sense of the antecedent contain that of the consequent. He claimed that conditionals which satisfy the stronger requirement express laws of nature (*lex naturae*). They do not confirm to the paradoxical principle that anything follows from an impossibility and so may be used without triviality in reasoning about impossibilities. Alberic of Paris, however, was able to show that Abelard's account of the conditional was inconsistent with the basic principle of 12th-century logic that a proposition cannot entail its own negation.

In order to save the theory of the conditional from this embarrassment, the Porretani took the very striking step of giving up the principle of simplification, that is that both conjuncts follow from a conjunction. They insisted that a conditional of the form 'if P and Q, then R' is true only if both P and Q are relevant to R, thus rejecting conditionals like 'if the Seine flows at Paris and Socrates is a man, then Socrates is an animal'. Their position seems very similar to that developed in 20th-century connexive logic but so far little work has been done to investigate it. No work at all has been done on the relationship between their metaphysics and their choice of logic.

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CHRISTOPHER J. MARTIN

Gilson, Etienne

Etienne Gilson was born in Paris in 1884 and died at Auxerre in 1978. After studying at the University of Paris and at the Collège de France under Henri Bergson, Gilson taught at the Universities of Lille, Strasbourg, and Paris. He lectured widely in Europe and North America, cofounding the Institute of Mediaeval Studies in Toronto in 1929. In 1932 he was elected to the Collège de France and in 1946 to the Académie Française.

For Gilson, as for Thomas Aquinas, metaphysics is knowledge of the first principles and causes of things. It "looks behind and beyond experience for an ultimate ground of all real and possible experience" (*The Unity of Philosophical Experience*, 1937). Unlike Christian Wolff, Gilson does not conceive metaphysics as an ontology, or general study of being, distinct from natural theology. Rather, he regards it as a unitary science which begins with the inquiry into being *qua* being and ends with the study of God as the first cause of being.

Being, Gilson contends, is the first principle of knowledge; for every aspect of reality, and even of unreality, is necessarily conceived as being. He points out that philosophers have often substituted for being one of its many forms or modes. Some interpret being as anything that can be grasped in the definition of an essence. In their view, essence, as a possible being, is at the heart of reality; actual existence is only an addition or mode of essence, whose function is to distinguish a real being from one that is only possible. Hence existence can be set aside or bracketed as uninteresting. Gilson calls philosophies that neutralize existence in this way "ontologies of essence". With Aquinas, Gilson claims that existence (*esse*) is not only intelligible but it is the source of the reality and intelligibility of essence. The first and innermost principle of being is not essence but existence, understood as the act whereby a thing exists. Unless a thing exists in some way – mentally or extramentally – it is nothing. Thus metaphysics is profoundly existential, but in a different sense from that conceived by modern existentialism. The latter is a philosophy without essence, and it often regards existence as meaningless or absurd. Thomism can be called existentialism as it should be understood (*Being and Some Philosophers*, 1949). Passing beyond the perspective of phenomenology, it establishes the act of existing as the keystone of metaphysics.

Gilson holds that existence is not apprehended in a quidditative concept but in a judgement of the type 'Socrates exists'. A true existential judgement affirms existence of something, uniting them in thought as they are united in reality. We have no intellectual intuition of the act of existing by itself; this act is conceived only in the concept of being, in conjunction with the essence whose act it is.

All beings we experience are really composed of an essence and an act of existing. Their essence is potential to, and receptive of, this act, which in turn determines their

existence to be of the kind it is. For example, the essence 'humanity' determines Socrates' existence to be human.

Metaphysics culminates for Gilson in the demonstration and study of God as the pure or subsistent act of existing. God is beyond being (*ens*); he simply is (*est*), and so his proper name is 'he who is'. The divine essence remains wholly unknown to us in itself; we know it only as it is reflected in creatures. God is best known by realizing that he surpasses everything we can know of him.

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ARMAND MAURER

Gnosticism

Gnosticism, or gnosis, is the term given to a cluster of theosophical systems arising around the beginning of the Christian era, and flourishing particularly in the 2nd and 3rd centuries AD, which are characterized by a strongly dualistic world-view, a negative attitude to the physical world, and a belief in salvation for a small élite through ascetic practices (or alternatively, but less characteristically, libertinism) and the acquisition of hidden 'knowledge' (γνῶσις). These systems had little formal structure, but were dependent rather on the personalities of a number of charismatic individuals, who usually composed sacred books, either in their own names or in those of mythical or historical figures. Some of these books (though, unfortunately, none of the main works of the chief figures) have been rediscovered since 1945 in Nag Hammadi in Egypt. Before that our information was almost entirely derived from hostile sources, usually orthodox Christian writers – particularly Irenaeus of Lyons (*c.* 130–*c.* 200), Hippolytus of Rome (*c.* 175–235), and Epiphanius of Salamis (*c.* 315–403).

The origins of the gnostic movement are obscure and much disputed. The main problem is whether a distinctively pre-Christian gnosis can be discerned, or whether all that we know as gnosticism arises from unorthodox Christian reactions to the Old and New Testaments. There seems now to be a consensus that the roots of gnosticism are to be seen, if not in Iranian dualism – as was the view of such scholars as Wilhelm Bousset and Richard Reitzenstein, then at least in the milieu of unorthodox Judaism, the Judaism of intertestamental apocalyptic and wisdom literature, which goes back at least to the 2nd century BC (e.g. the *Book of Daniel*), as is the view of such scholars as Gilles Quispel and Kurt Rudolph. Followers of such movements believed that the world was soon to end, being now in the grip of evil demons, and that only a small élite, being those to whom the apocalypses have been revealed, can be redeemed by this hidden knowledge. The secretaries of Qumran, authors of the Dead Sea Scrolls, may be seen as part of this milieu. Certain personalities of the Old Testament, such as Adam, Seth, Cain, Shem, and Noah, are picked out as spiritual ancestors (cf. e.g. *The Apocalypse of Adam* or *The Three Steles of Seth*). Such figures as Enoch, Baruch, and Ezra are presented as paradigms of the elect who can reach true knowledge of God. God himself, now raised to an almost unbridgeable transcendence, is given intermediaries such as the Son of Man or Wisdom (*Sophia*), through whom he may communicate with the world. All that is needed for fully developed gnosticism is the idea that the world is the creation of, and the domain of, a positively evil, or at least ignorant and perverse, deity. That is a legacy to gnosticism from the strong dualism of Iranian religion.

While unorthodox Judaism may be seen as the seed-bed of gnosticism, we must also recognize that Greek philosophical ideas, particularly those of Platonism and Pythagoreanism, play an important part in its devel-

opment, at least in its 2nd-century form. It can be viewed as part of the 'underworld' of later Platonism, other manifestations of which are the Hermetic corpus and the Chaldaean Oracles. The God of this world, though owing much to the Yahweh of the Old Testament, nevertheless acquires the title of Demiurge, borrowed from Plato's *Timaeus*. The ideal world, or πλήρωμα, likewise is a concept borrowed from the intelligible world of Forms presented in that dialogue. It is not for nothing that heresiologists like Hippolytus accuse the Gnostics of deriving their ideas from one Greek philosophical school or another, despite the fanciful nature of the connections that they discern.

The earliest gnostic leader identified by the orthodox tradition was Simon of Samaria, a contemporary of the Apostles. Simon is presented in the Acts of the Apostles (8, 9–25) as a mere venal charlatan, trying to jump on the bandwagon of Christianity; but he is better seen as an independent teacher, arising from a dualistic Samaritan tradition, presenting an early form of the later 'Barbelognostic' system. The latter is represented in the Nag Hammadi corpus by the *Exegesis on the Soul*, according to which the supreme God projects a female principle, his thought (ἔννοια), which falls, and so brings the world into being, and itself into servitude, from which it must be rescued by a saviour figure. Followers of Simon in the latter part of the 1st century are Menander and Satornilos. It is Satornilos who is probably the author of the "Great Proclamation" (Μεγάλη Απόφασις) and who introduces the notion of two distinct types of man, one wicked, the other good, and of Christ as a gnostic redeemer, coming only to save the good.

Gnosticism reaches its climax, however, in the second half of the 2nd century, spreading out from Syria-Palestine in the direction of Alexandria and of Rome. Three teachers of particular importance in this period are Basilides (fl. *c.* 125), Marcion (*c.* 100–*c.* 165), and Valentinus (2nd century), all of whom originated in, or spent time in, Alexandria, and subsequently gravitated to Rome. The majority of all gnostic literature known to us, including the Nag Hammadi corpus, dates from this period, as do the sects best known both from the heresiologists and from original writings, the Ophites, Naassenes, Cainites, Sethians, Valentinians, and Peratae. By the end of the 4th century, after the triumph of orthodox Christianity, most gnostic sects were eliminated and their writings destroyed, except for the Manichaeans and their offshoot the Mandaeans, the latter of whom survive in Iraq to the present day.

All the developed gnostic systems share concepts with Greek philosophy, particularly Platonism, and it is not always clear, in relation to later Platonism, in which direction the influence goes. Besides the Demiurge and the intelligible cosmos, Basilides's concept of a primal God that is 'non-existent' and Valentinus's of the 'pre-existent forefather' seem to owe something to an interpretation of the famous description of the Good in Plato, *Rep.* VI 509 as 'beyond being', while such concepts as ἔννοια and σοφία seem to be mythological personifications of the Platonic-Pythagorean Indefinite Dyad. On the other hand, the motif of the 'fall' of σοφία, which creates the physical cosmos, seems to contribute something to Plotinus's doctrine of the creative 'fall' of the soul (much though Plotinus objects to the world-negating attitude of the Gnostics, cf. *Enn.* II 9). The influence of a gnostic world-view on Middle Platonists such as Plutarch (*c.* 46–*c.* 120), Atticus (*c.* 176), and Numenius (*c.* 150–200) is more pervasive than οι Plotinus, though, as has been said above influences are plainly working in both directions.

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JOHN M. DILLON

Goclenius, Rudolphus

Rudolphus Goclenius (Rudolf Göckel) 'the elder' was born in 1547 at Corbach in Waldeck, where he attended school until 1564. It seems that he spent some time in Erfurt, at least until 1567, after which he studied at the University at Marburg. From 1568 to 1570, he attended the university in Wittenberg, and his famous son, the physicist Rudolf ('the younger') was born there in 1572. Towards the end of 1581, he was appointed professor of physics at Marburg University, at which university he taught until his death. During 1589 he became professor of logic and, a few years later, professor of mathematics. After 1603, he was both professor of logic and ethics. In 1605 he gave up lecturing on logic, but later he took it up again and remained in that post until his death in 1628.

Goclenius's most important metaphysical works include: *Isagoge in peripateticorum et scholasticorum primam philosophiam, quae dici consuevit metaphysica* (1628); *Conciliator philosophicus* (1609); and his most famous work, the *Lexicon philosophicum* (1613).

Goclenius is best described as a 'Protestant Scholastic', his most important contribution to the metaphysics being terminological. He is the first philosopher to use the word ὀντολογία to describe general metaphysics (but see Vollrath 1962, p. 266). Strangely enough, this word does not appear in the *Isagoge*, but rather in the *Lexicon*. Still, his use of the word precedes that of Calovius by 23 years (cf. Wundt 1939, pp. 94 and 171), and that of Jean-Baptiste Duhamel by 65 (cf. Copleston 1959, p. 356).

Although he does not use the term ὀντολογία in the *Isagoge*, Goclenius does distinguish general metaphysics from special metaphysics in this work and *a fortiori* understood the concept of general metaphysics. The distinction between general and special metaphysics is not Goclenius's invention, however. The Spanish Jesuit Benito Pereira (*c.* 1535–1610) had already made it by 1562 (see Rompe 1968, pp. 7–13) and an earlier manuscript making the distinction has been found (Zimmermann 1965, p. 60).

Both Wundt and Vollrath seem to have discovered the distinction between general and special metaphysics only in the *Praefatio* of Goclenius's *Isogoge* and have remarked that this distinction does not appear in the main text of the work. This is incorrect, however. The second part of the *Isagoge* is a series of disputations, the first of which, entitled *De ente Communi, ad omnes Categorias consequente* discusses this distinction (Rompe is aware of this and hers is at present the most trustworthy account of Goclenius's work). Goclenius says that some divide first philosophy (*prima philosophia*), which is usually called 'metaphysics', into two parts. The first is universal and studies the most general notion of being common to all things (*de Ente in communi*). The second part is particular and deals with God, divine spirits (*daemones*), and disembodied intellect (*intellectus separatus a corpore*, p. 126). Goclenius ascribes this view to Aristotle and then goes on to say that he prefers to divide things up differently. Knowledge (*scientia*) should be divided into a universal and a particular part, and the universal part should be called 'first philosophy'. The particular part in turn should be divided into a 'transnatural' part which deals with God, and a 'natural' one, which deals with natural entities (pp. 126–7).

Goclenius's idea of knowledge, then, has a particular part which seems to contain every specific science. In contrast, Perera includes only theology, 'spiritology', and psychology, and Christian Wolff only theology, psychology, and cosmology, within special metaphysics. Thus Goclenius is proposing a way of cutting up the sciences such that *prima philosophia* is truly cast in the role of the queen of the sciences, lording over them all as the *scientia universalis*. On the face of it, Goclenius's taxonomy of metaphysics is more reasonable than that of Wolff or Pereira. If one is going to take seriously the notion of a 'superscience' which studies the most abstract idea of being which the objects of all specific sciences share, then one is compelled, I think, to include *all* of the particular sciences within specific metaphysics. This is true *unless*, of course, one has platonic misgivings about the possibility of being able

to have knowledge about substances which have matter mixed up in them. However, a good Scholastic, wedded as he is to the spirit of Aristotle, has no such misgivings.

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JEFFREY COOMBS

God
I: Natural and Revealed Theology

In attempting to articulate a precise conception of God, philosophers and theologians have traditionally relied on two different approaches, natural theology and revealed theology. Natural theology, which develops a concept of God solely on the basis of logical and metaphysical considerations, has two main strands. The first, *a priori* natural theology, attempts to delineate the concept of God by investigating the logic of that concept. Its most famous representative, Anselm of Canterbury, claimed that the concept of God is the concept of that than which nothing greater can be conceived, and he argued that not only the existence of such a being but many facts about its nature follow from this conception. A being than which none greater can be conceived must possess all perfections, i.e., all those attributes it is intrinsically better to have than to lack, and so one can identify the divine attributes by determining which properties are perfections. According to Anselm, God's attributes must include, e.g., justice, omnipotence, omniscience, and impassibility because these are perfections.

Other philosophers and theologians have followed Anselm's *a priori* approach but have disagreed with him about what properties it is better to have than to lack. For example, in *The Divine Relativity* (1948), Charles Hartshorne argues that immutability and impassibility, properties Anselm took to be divine attributes, are not in fact perfections. Hartshorne claims that the property of sociability or personality, which entails the ability to respond to and interact with creatures, is a perfection, and hence that God ought to be conceived of as sociable and dependent on other things rather than as immutable and impassible.

The second strand within natural theology, *a posteriori* natural theology, conceives of God as part of a hypothesis required to explain certain phenomena. *A posteriori* natural theology argues for a certain conception of God on the basis of the nature of the phenomena the theistic hypothesis explains. Thomas Aquinas, e.g., argued that the existence of a being that is pure actuality (*actus purus*) is required to explain the existence of a contingent universe. A being that possesses complete actuality, he argued, possesses every perfection, and so is perfectly good. Such a being must be entirely self-sufficient and metaphysically independent and, because of its independence, must be metaphysically simple, and hence incorporeal (having no spatial parts), eternal (having no temporal parts), and immutable (having no intrinsic accidental properties).

Proponents of both sorts of natural theology have generally agreed that God must be a perfect being, that as such God must be the unique ultimate reality (the *ens realissimum*) and source of all things other than himself, and that perfection requires at least a certain core group of attributes (e.g., omnipotence, omniscience, perfect goodness). They have disagreed, however, about the precise characterization of these

attributes and whether perfection requires certain other attributes (e.g., necessary existence, atemporality, simplicity, immutability, personality).

Critics of these sorts of natural theology have raised three basic objections. First, they have argued that the concept of a perfect being is incoherent. Most arguments of this sort attempt to establish that the notion of perfection itself or some attribute entailed by perfection (e.g., omnipotence) is incoherent, that certain attributes of a perfect being are incompatible with one another (e.g., omniscience with immutability, omnipotence with perfect goodness), or that certain attributes of a perfect being are incompatible with some feature of the world (e.g., omnipotence, omniscience, and perfect goodness with the existence of evil, omniscience with human freedom). Second, critics such as David Hume have argued that the evidence used by *a posteriori* natural theologians does not support their conception of God as a perfect being. They have claimed, e.g., that certain cosmological and teleological arguments, if successful, show not that God must be omnipotent but only very powerful. Third, some critics have argued that the evidence appealed to by *a posteriori* natural theologians cannot provide the basis for any determinate conception of God since God must be radically unlike the finite, contingent objects of human experience.

The other approach, revealed theology, starts from some special religious experience or some body of revelation and attempts to develop a concept of God on the basis of the content of that experience or revelation. Revealed theology in the Judaeo-Christian tradition, e.g., focuses primarily on the Scriptures of that tradition, which portray God as Creator, moral judge, and provident agent actively involved in historical events, and attempts to develop a coherent and systematic concept of God on the basis of evidence of this sort.

Some have thought that the results of these two different approaches to developing a concept of God are incompatible. They have denied, e.g., that an immutable or atemporal perfect being could be identical with the being described by revelation as one who intervened in the history of Israel or became incarnate in Jesus Christ, or that the being who commanded Abraham to sacrifice his son and slaughtered the Egyptian first-born could be perfectly good.

But there are reasons for thinking that the two approaches are not only compatible but complementary and perhaps even convergent. First, each approach by itself seems to underdetermine the concept of God, and so practitioners of the one might welcome the supplementary evidence provided by the other. Second, natural theology might provide one with good reason to expect that a perfect being would communicate certain important truths to human beings by means of a special revelation: one might argue, e.g., that a perfectly good being (who is omniscient and omnipotent) would be concerned for human well-being and could be expected to communicate to human beings truths necessary for their attaining well-being (e.g., truths about the means to salvation). Given that a perfect being could or might be expected to provide a special revelation, natural theology must take seriously the contents of revelations which are compatible with the conception of God as perfect being. Third, considerations of coherence and systematic completeness might lead revealed theology to a conception of God as perfect being: one might argue, e.g., that scriptural evidence requires one to hold that God is worthy of worship and that logical considerations show that only a perfect being could be worthy of worship, or that the biblical conception of God as Creator entails that God is the ultimate source of all reality, and hence metaphysically independent and self-sufficient. Fourth, each approach might be taken as offering not only positive evidence supplementary to the evidence provided by the other approach but also a negative check on the results of the other approach: the conception of God as perfectly good might prevent one inferring from the story of Abraham and Isaac that God is to be conceived of as utterly capricious, while the scriptural claims of divine activity in the course of history might prevent one from accepting a concept of perfection that entails that such activity is impossible.

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SCOTT MACDONALD

God
II: Metaphysical Conceptions

Conceptions of God correspond to ontological understandings of the world. In Western natural theology (followed in this article), divine attributes *contrast* with worldly properties or *surpass* those (largely human) 'perfections' which it has seemed more fitting to have than to lack. The first approach is called negative, apophatic theology, or *via remotionis*, and the second positive, kataphatic theology, or *via eminentiae*.

God is *one*, *unique* (the *only* God) and *simple* (lacking worldly multiplicity), *spiritual* (immaterial), *eternal* (timeless or of boundless time), and *unmoved*. He is *immutable* (exempt from change or becoming) and *infinite* (limitless). For John Duns Scotus infinity is the most perfect concept of God and the mode of his attributes.

God is *transcendent*, independent of the world, self-sufficient, essentially other than worldly beings. Transcendence has been stressed not only by deism, but by much theology since Karl Barth (1886–1968). God is incomprehensible, at least in the sense that natural reason cannot grasp him 'in himself'. *Homo religiosus* has considered God radically mysterious or holy. God is *ultimate*, absolute, and unconditioned, 'from himself' (*a se*); the world is relative, 'from the Other' (*ab alio*). He is *necessary* being (cannot not be), while worldly things are contingent (are, but can fail to be). Aristotle thought that God is fully *actual*, and Thomas Aquinas that this actuality is pure ('essenceless') *esse*. (God is not a being of a certain description which exists, but his existing itself.)

For Plato, God did not create matter or (perhaps) the Forms, but in the Judaeo-Christian tradition, God accounts ontologically for all being: for abstract essence, since it is identified with God as the 'divine ideas' of his mind, and for concrete existence, since he is the *Creator-Conserver* (on-going Creator) of the world 'from nothing' through his will. God is *immanent* in the world, present as its source (but for pantheists like Spinoza, divinity is an aspect of the world itself). Immanence grounds God's natural knowability (in contrast to the 'faith' of revelation and religious experience).

God is *alive* and, as *personal*, shares human mental and moral properties. He is *conscious*, *intelligent*, knowing, and for Aristotle 'thought of thought'. As 'first truth', he is indeed *all-knowing* (logical problems of omniscience have been discussed from Augustine to the present day). God is *rational* and *provident*, accounting for the 'order' or law of nature. God is *free* to create. (In Neoplatonism, however, existence, not only essence, emanates necessarily from the One.) He is *almighty* (though the scope of omnipotence is usually limited in traditional and contemporary discussions of how divine power is related to human free will and to the fact of evil).

God is morally *good*, grounds human ethics, and (eschatologically) fulfils human history. Paul Tillich (1886–1965) related the Absolute to man's ultimate concern (and Hegel to cosmic denouement). In sum, God is the greatest possible, or *maximally perfect*, being. (Nicholas of Cusa and process philosophers such as Charles Hartshorne seek to resolve contradictions arising from contrasting divine properties.)

Like Søren Kierkegaard (1813–55), recent theologians tend to discount arguments for God's existence, but today analytic philosophers are re-examining both traditional 'proofs' and 'disproofs'. Typically, *a posteriori* (cosmological, teleological, etc.) arguments contain at least one 'factual' premiss, and *a priori* arguments ('ontological', etc.) lack such presupposition. For some philosophers religious belief is 'basic'. Thus, for example, Alvin Plantinga argues that belief in God's existence is justified even without evidence.

Cosmological arguments are, for example: the fact that some things change, are, or are but need not be, points to a being accounting for their becoming, existence, or contingence. From the perspective of the *teleological* argument, a 'designer' must account for the lawfulness of nature (cf. William Paley, 1743–1805). In Kant's *moral* argument, human moral law 'postulates' God's existence.

Anselm of Canterbury's *ontological* argument, based on the idea of a maximally perfect being, rejected by Aquinas and Kant but accepted by René Descartes and Leibniz, is much discussed today in analytic philosophy. An example of a recent modal formulation: the conclusion ('God must be') is sound, since the conjunction of its negation ('God need not be') with an 'Anselmian' premiss ('necessarily, if God is at all, he must be'), and a premiss about God's possibility ('God can be') yields (in the modal system S5) a logical contradiction.

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WALTER REDMOND

Gödel, Kurt

Kurt Gödel (1906–78) is beyond doubt the greatest mathematical logician of our century. Not only the results he obtained but also the notions and methods he introduced in order to obtain these results are of paramount importance. He is not the inventor of modern mathematical logic (this honour belongs to Gottlob Frege), but he transformed mathematical logic into a precise and essential part of mathematics. Besides their mathematical significance his major achievements have a deep epistemological and ontological significance and are thus also part of philosophy.

We shall start with a discussion of Gödel's completeness result of 1930. What he proved is the following:

(*) Let Σ be a countable consistent set of first-order sentences, then Σ has a countable model.

Here consistency is a syntactical property of Σ, meaning that no contradiction can be deduced from Σ by the usual logical rules (effectively the rules of Frege's system restricted to first-order logic). On the other hand, having a model (in the usual sense) is a semantic notion. In the logical tradition prior to Gödel both logical syntax and logical semantics were treated, the first e.g. by Frege and Bertrand Russell/A. N. Whitehead, the latter by Ernst Schröder (1841–1902), Leopold Löwenheim (1878–1957), and Thoralf Skolem (1887–1963). Although, by its very nature, the completeness question raised by D. Hilbert and W. Ackermann in their book *Grundzüge der theoretischen Logik* (Berlin, Springer, 1928) connected syntax and semantics, it was Gödel who really established this connection via (*).

From a philosophical point of view, consistency is an epistemological notion, and having a model an ontological notion. Thus (*) connects these two notions, in the realm of first-order logic. More concisely, (*) may be read as 'consistency implies existence'. However, what can be deduced to exist may not correspond to our intentions. For let Σ be a set theory in which one can prove that there are uncountable sets, then Σ, if consistent, has a countable model. This is called Skolem's Paradox, though the result is not, in fact, paradoxical at all.

An immediate corollary to (*) is the compactness theorem (for countable Σ):

If each finite subset of Σ has a model, then Σ has a model.

(This was generalized by Malcev in 1936 and by Henkin in 1949 to uncountable Σ.) The compactness theorem uses, in its statement, no syntactical (epistemological) notions: Łos gave in 1955 a purely semantic proof of it using ultraproducts. The compactness

theorem (for uncountable Σ) is the foundation of non-standard analysis, which Gödel himself considered as a natural extension of ordinary analysis.

On the mathematical side, Gödel's completeness theorem is the starting-point and cornerstone of model theory, which was later developed by Alfred Tarski and his school, and also by Abraham Robinson. On the more logical side, it formed a paradigm for a whole completeness industry: and we have now completeness theorems for modal logics, type logics, infinitary logics, program logics, and so on.

Due to methods worked out by Leon Henkin, the construction of models from consistent sets becomes especially simple. Effectively one constructs models by using the formulae themselves as objects. The transition from consistency to existence is thus often a matter of theft rather than honest toil. Ontologically interesting models cannot simply be extracted from consistent sets of sentences but require proper mathematical constructions.

The most famous result of Gödel is his proof of the incompleteness of formalized arithmetic of 1931. In the popular and therefore also in the philosophical literature, this result is mostly considered as a negative and frustrating one. Its positive aspects are, however, more numerous and more interesting. On the one hand, Gödel's results of 1931 may be seen as putting an end to certain hopes of Hilbert (these are their negative aspects); on the other hand, the methods used in obtaining them are at the beginning of recursion theory and therefore fundamental for computer science (the positive aspects).

Georg Cantor's informal set theory opened up a world of structures (called 'Cantor's paradise' by Hilbert) into which then existing mathematics could be easily coded. However, it was at first not clear how to axiomatize this theory, and in fact Frege's system, which attempted to axiomatize parts of it, was shown by Russell to be inconsistent. Ernst Zermelo's axioms (later enlarged by Abraham Fraenkel's axiom of replacement) and *Principia Mathematica* of Whitehead and Russell gave a formal codification of (parts of) Cantor's set theory of sufficient deductive strength for most practical purposes of the mathematician. The Euclidean deductive ideal was hereby re-established in the realm of set theory (and therefore of 'the whole of mathematics').

But what about the consistency of these systems? Here Hilbert made the following simple observation. Although, e.g., Zermelo's axiom system speaks about infinite entities, every proof in it is a finite entity. ("Schaut man in den Kalkül, dann ist nichts Unendliches da" – Wittgenstein.) Now, the system is consistent, if no proof in it ends with a formula like $0 = 1$. Thus consistency is a statement about *finite entities* and of the same nature as a statement of number theory.

In accordance with a (not fully analysed) ideal of purity of method, Hilbert demanded that statements about finite entities should be proved by finitary methods; more especially, he demanded that consistency should be proved by such methods. This is Hilbert's Programme.

In 1930 Gödel tried to prove the consistency of analysis (i.e. of second-order arithmetic, which can be considered as a proper part of Zermelo's system, or of *Principia Mathematica*) by reducing it to the consistency of first-order arithmetic. In pursuing this aim he encountered several obstacles connected with paradoxes of definability (of truth). To anticipate his final results of 1931, it is easily seen that even the relative consistency proof for second-order arithmetic from that of first-order arithmetic cannot be carried out in second-order arithmetic – and *a fortiori* not by 'finitary means'.

Gödel's result of 1931 is proved for the system of *Principia Mathematica*, which is the logic of all finite types with full comprehension and choice over the theory of natural numbers at the ground type. We outline a proof for PA or Peano-arithmetic. PA is formulated in first-order logic with equality and the non-logical symbols $0, s, +, \bullet$. Its non-logical axioms are $0 \neq sx$, $sx = sy \rightarrow x = y$, the recursive equations for $+$ and $\bullet$, and the induction scheme. Hilbert's observation that proofs are finite objects is taken seriously by Gödel in a radical way: proofs 'are' natural

numbers, as also are all of the parts entering proofs, which is to say formulae. The process which leads to the desired identification of the various formal objects of a formal system of arithmetic with natural numbers is called *arithmetization* or Gödelization and is well known today to every beginner in logic. Although the idea is natural, Gödel was the first to carry it out. (It should be remarked that already Leibniz played with the idea of arithmetization – of syllogisms, but obtained no decisive results.)

The next crucial step was the realization that decidable relations between natural numbers can themselves be represented in the system PA.

The stage is now set for the two incompleteness theorems.

Whether a sequence of formulae constitutes a PA-proof of the sentence φ is decidable. Hence, if PA $\vdash \varphi$ then there is a natural number x (a Gödel-number of a proof) such that Bew $(x, \ulcorner\varphi\urcorner)$ holds, where $\ulcorner\varphi\urcorner$ is the Gödel-number of φ and Bew is the decidable relation holding between the Gödel-numbers of proofs and the Gödel-numbers of the proved sentences. Let $\overline{\text{Bew}}$ be the representing formula for Bew. Then PA $\vdash \overline{\text{Bew}}\,(x, \ulcorner\varphi\urcorner)$ by the representability of all decidable relations. Hence PA $\vdash \text{Prov}(\ulcorner\varphi\urcorner)$ where $\text{Prov}(x)$ is defined as $\exists x \overline{\text{Bew}}(x, y)$.

Thus we have shown the first 'derivability condition':

1. $\text{PA} \vdash \varphi \Rightarrow \text{PA} \vdash \text{Prov}(\ulcorner\varphi\urcorner)$.

Since PA proves only things that are true in the standard model of arithmetic we have also the converse of 1., namely

1.* $\text{PA} \vdash \text{Prov}(\ulcorner\varphi\urcorner) \Rightarrow \text{PA} \vdash \varphi$.

Simple arguments now establish:

2. $\text{PA} \vdash \text{Prov}(\ulcorner\varphi\urcorner) \wedge \text{Prov}(\ulcorner\varphi \to \psi\urcorner) \to \text{Prov}(\ulcorner\psi\urcorner)$.

3. $\text{PA} \vdash \text{Prov}(\ulcorner\varphi\urcorner) \to \text{Prov}(\ulcorner\text{Prov}(\ulcorner\varphi\urcorner)\urcorner)$.

It is also easy to show:

Gödel's Fixed Point Theorem. Let $\varphi(x_0)$ be a formula of PA with x_0 as its only free variable. Then there is a sentence ψ of PA such that $\text{PA} \vdash \psi \leftrightarrow \varphi(\ulcorner\psi\urcorner)$.

Moreover, ψ can be effectively constructed from $\varphi(x_0)$, using the substitution function.

Let now $\varphi(x_0)$ be the formula $\neg \text{Prov}(x_0)$. Then the corresponding fixed point ψ is such that $\text{PA} \nvdash \psi$ and $\text{PA} \nvdash \neg\psi$ as one shows easily using the above-stated derivability conditions. This is Gödel's first incompleteness theorem, and ψ is the famous sentence which expresses, PA-provably, its own unprovability.

Let Cons be the sentence $\neg \text{Prov}(\ulcorner 0 = 1\urcorner)$. Then, again using the derivability conditions, one shows $\text{PA} \vdash \psi \leftrightarrow \text{Cons}$, hence $\text{PA} \nvdash \text{Cons}$. (Second incompleteness theorem.) Tarski's theorem that arithmetical truth is not arithmetical is also an immediate consequence of the above Fixed Point Theorem.

Much has been written about the philosophical importance of these incompleteness results. First, they prove that certain ideals of purity of method are untenable. It is certainly true that the ontology of number theory, namely the intended model of arithmetic, is *finitary*, since all natural numbers are finite entities and s, $+$, $\cdot$ are also finitary (computable) operations. But does it follow that the knowledge of this structure is also finitary, and if so, finitary in which sense?

Gödel's results show that our knowledge of the intended model of arithmetic is non-finitary in a dramatic sense. It is true that Cons has the form $\forall x(\text{f}(x) = 0)$, where f is an elementary function, or of the form $\forall x_1, \ldots, x_n(\text{p}(x_1, \ldots, x_n) \neq 0)$ where, by Matiyasevicz's negative solution of Hilbert's Tenth Problem, p is a polynomial over $\mathbf{Z}$ that is not formally decidable in PA. Thus *if* PA codes all finitary reasoning, there is no finitary proof of the finitary statement Cons.

As Gentzen showed, however, there is a non-finitary proof of Cons, using induction up to ε_0. Gödel remarks to this, that induction to ε_0 is not intuitively or concretely accessible.

Moreover, even if a statement φ has a finitary proof (or a proof in PA), it may have a better proof in higher (stronger) systems; i.e. a proof which violates the ideal of purity

of method. Such a proof may be better in two respects:

1. It may be conceptually clearer.
2. It may be much shorter.

The second point is crucial, since in this case we may save time and paper. Indeed Gödel showed (essentially using the methods of his incompleteness proof) that there are theorems of PA which have a much shorter proof (measured in advance by a recursive function) in second-order arithmetic than in PA itself.

In 1958 Gödel himself gave a consistency proof of PA via the so-called functional interpretation. This proof uses the abstract notion of a primitive recursive function of finite type; it is more informative than Gentzen's proof and also conceptually more transparent.

It is reported that Gödel after his incompleteness results said repeatedly: 'Now for set theory.' Consider, e.g., the axiom system ZF (Zermelo–Fraenkel), without the axiom of choice. This theory has an obvious, although highly non-constructive, model, viz. the cumulative hierarchy, which is generated from the empty set by iteration of the power set operation through all ordinals. The explanatory power of this model is already exhausted by its being a model of ZF. Thus for example we cannot see whether or not the axiom of choice (AC) is true in it; neither can we see whether Cantor's Continuum Hypothesis (CH) is true in it.

Gödel's great idea was to define a slender sub-hierarchy of the cumulative hierarchy, the hierarchy L of constructible sets. Roughly speaking, L is the hierarchy of definable sets, given the ordinals. (One goes from the level L_α to the level $L_{\alpha+1}$ by taking not the full power set, as in the cumulative hierarchy, but the definable sets, with parameters in L_α.)

Let V = L be the statement, that all sets are constructible. Gödel showed:

1. $ZF \vdash \varphi \Rightarrow ZF \vdash \varphi^L$, where φ^L is the relativization of φ to L.

2. $ZF \vdash (V = L)^L$.

In 2. we have another case of self-reference (parallel to the arithmetical case of $PA \vdash \psi \leftrightarrow \neg \mathrm{Prov}(\ulcorner \psi \urcorner)$):

> L says ZF-provably, that L itself is the whole universe.

Now it follows from 1. and 2. that if ZF is consistent, so is ZF + V = L. GCH, the Generalized Continuum Hypothesis (i.e. $\forall \alpha\ 2^{\aleph_\alpha} = \aleph_{\alpha+1}$) and AC are theorems of ZF + V = L. Thus, if ZF is consistent, so is ZF + GCH + AC. (This relative consistency proof can be carried out in primitive recursive arithmetic.) The notion of constructible sets is accordingly an important one. Nevertheless, Gödel himself did not believe that L is the true universe of sets. There are two kinds of reason for rejecting L as the true universe, one mathematical, the other philosophical.

As for the first, V = L implies that there is a Δ^1_2-set of reals which is not measurable, and this is highly implausible.

The philosophical reasons are connected with Gödel's Platonism, according to which the true universe of sets must be much bigger than L. Indeed, the true universe may also be much longer than L; for if there is an uncountable measurable cardinal (yielding a new stage in the construction of sets), then V = L is refutable (a result of Dana Scott).

As is well known, Paul J. Cohen showed in 1963 also the unprovability of GCH and AC. For the last twenty years of his life Gödel searched (in vain) for *true* axioms which would decide CH (and GCH). In contrast, he thought that AC was obviously true.

We have not touched upon other significant achievements of Gödel, e.g. his contributions to intuitionism, to decidable subclasses of the predicate calculus, and to relativity theory.

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J. WOLFGANG DEGEN

Good

The traditional use of the metaphysical or ontological concept of good is determined above all by Plato (*Rep.* 506d–509d) and Aristotle (*Nic. Eth.* I, 1 and 4). In Plato's analogy of the sun, the Good stands beyond essence; that is, it escapes every conceptual determination. The Idea of Good is itself good in as much as it is the origin of being and of knowledge. This conception was developed by Plotinus (*c.* 205–70). The Good is not a being; it is the power which generates being, without thereby being lessened or relinquishing its transcendence.

In the *Nicomachean Ethics* Aristotle considers as a definition, "Good is that for which each thing respectively aspires". 'Good', he says, is a transcendental predicate. It is no more a universal concept than 'being' itself. When used as an attribute, 'good' can be applied to terms from every category. The meaning and relevant category, however, change according to the supplementary expression that is employed. '*X* is a good medicine' is a statement in the category of action; '*X* is a good man', a statement in the category of quality (*Top.* I, 15). The question of the unity of the concept was answered by Aristotle by appeal to his ontology. Activity is ontologically distinguished from power. The goodness of a being is measured by the perfection of the activity which it performs (*Eud. Eth.* II, 1). Since every being performs a specific activity, 'good' or 'the good' is an analogous concept. That which is health for the body is seeing for the eye and knowing for the mind (*Eud. Eth.* I, 8; *Nic. Eth.* I, 5). The question whether something is good because it is desired or desired because it is good is answered by Aristotle in the second of these two senses. A thing is good in as much as it is such as to move an appetite (*Met.* XII, 7; *De An.* III, 10).

In his *Summa de bono*, Philip the Chancellor (d. 1236) classifies the *rationes boni* as these had been taken over from antiquity. According to the first and most fundamental of these, an essence is good the act and potency of which cannot be separated. From this it follows that good 'communicates being' (*est communicativum alicuius esse*). The third determination is that the good is desired by every single thing. The formula '*Bonum et ens convertuntur*' is found for the first time in the *Summa*. With this there is posed the question how 'good' and 'being' relate to each other.

For Thomas Aquinas 'good' is a first absolute determination of a being. As first, it can be described only through something subsequent which is caused by it, namely a desire. Desire stands in a *relatio realis* to the being, the being in a *relatio rationis* to the desire. The being is not good because it is relative to another, but because another is relative to it (*In I Ethic.* lect. 1, nr. 9; *De Ver.* q. 21, a. 1).

In the definition of William Ockham, a good is "something that can be willed or loved according to right reason" (*Summa logicae* I cap. 10) the constitution of the good through the rational will is foreshadowed; the relationship to the act of the will becomes for him an external denomination of being. This development comes to fruition in Thomas Hobbes, who expressly refuses to designate anything as good *simpliciter*. That which is good is always good for that which aspires to it (*De homine* cap. 11, §4). For Kant 'good' and the other transcendentals are not predicates of things but "logical requirements and criteria of all knowledge of things". Here he follows Christian Wolff in understanding the good as perfection. It consists in the reduction of a multiplicity of characteristics to a unity of concept (*CPR.* B 113–16).

See also: **Good and Evil**

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FRIEDO RICKEN

Good and Evil

There are many questions concerning good and evil that are of philosophical interest. For example, one may raise such different issues as their definition, classification, ontological status, causes, discernibility, and the meaning and use of the terms 'good' and 'evil'. All these issues are closely interrelated and answers to one will affect the answers to the others. In the present context, however, we are concerned only with the issue as to the ontological status of good and evil.

This issue has been formulated in various ways throughout the history of philosophy, but generally what has been sought for is an ontological characterization of good and evil. Are good and evil features of things, like green and yellow, or are they relations, like sisterhood? Are they real, or merely constructs of the mind? Giving an ontological characterization of something involves locating the thing in question in, as it were, a map of the most basic categories of reality. To ask for an ontological characterization of triangularity, for example, might involve asking for a determination of whether triangularity is a substance, quality, relation, or collection; whether it is something mental or something extramental; and determining its degree of objectivity and subjectivity. One might wish to hold with Plato, for instance, that triangularity is a real idea (perhaps a substance) that exists outside the world of sense perception. Or, with Aristotle, one may choose to maintain that triangularity is a structural form present in triangular things, but with no status outside them. Or, as Joscelin of Soissons (died 1151) did in the early Middle Ages, one might like to identify triangularity with the collection of all triangles, just as humanity might be identified with the collection of all human beings. Or one may decide to adopt, with David Hume, the view that triangularity is a vague idea present in the mind and derived through a weakening process from the vivid impression of particular triangles experienced in perception.

There are four basic positions with respect to the ontological status of good. They identify good

1. as being,
2. as an attribute of being,
3. as a type of being, and
4. as a collection of beings.

The third position is subdivided further, depending on the type of being with which good is identified:

a. a substance,
b. a feature of substance, or
c. a relation.

Corresponding to these positions there are also views concerning the status of evil.

1. Good as Being and Evil as Non-Being. The first position holds that being and good are one and the same: to be is to be good and vice versa. It finds support in the fact that under the right set of circumstances even what appears to be eminently bad or evil can be considered good. There is no intensional or extensional distinction, according to this view, between 'being' and 'good', and neither is there any distinction between 'non-being' and 'evil'.

Obviously this position faces many difficulties. That to be good is something different from to be, it is objected against it, is clear from the fact that some things that exist are not good and that it would be better for some things not to be than to be. And something similar could be said concerning 'evil' and 'non-being'. For these reasons there have been few defenders of this position in the history of philosophy, although one can easily find texts that seem to support it in Plato (*Rep.* VII) and in neo-Platonists like Plotinus (*Enn.* I, 8.3).

2. Good as Attribute of Being and Evil as Privation of Being. A second position argues that 'good' and 'being' are not intensionally equivalent, but that their extensions are the same. To be and to be good are not the same conceptually, but whatever is is good and vice versa. This is the position that most Scholastics adopted (cf. Albert the Great's *Summa de bono* I, 7, and Thomas Aquinas's *Sum. Theol.* I, 5) and is known in terminology popularized by Francisco Suárez as the doctrine of the 'transcendentality of good' (*Disp. Met.* III and X). The roots of this

position are to be found in Augustine's *On Free Will*, Boethius's *De hebdomadibus* and other early Christian writings. Good is conceived, according to the scholastic formulation of this view, as a transcendental attribute of being, along with other attributes such as unity and truth. A transcendental attribute, in contrast with a categorical one, extends to all Aristotelian categories. While white, for example, occurs only in the category of quality, good occurs in every category. Some Scholastics, like Suárez, formulated this doctrine by saying that good is really, but not conceptually, convertible with being.

That good is a transcendental attribute of being implies that it always accompanies being and, consequently, evil must be a lack of being. Supporters of this view of evil, however, distinguish between two types of lack. One is an absolute lack (also called 'negation'), such as man's lack of wings. The other is a lack relative to a thing's nature (also called 'privation'), such as a man's lack of sight, and defined as a lack of what a thing ought to have according to its nature. The distinction between privation and negation goes back to Aristotle's *Metaphysics* (IV, 2).

Opponents of the transcendental view of good and the privation view of evil typically argue against them on the basis of counter-examples. A cancerous tumour, for instance, *is something* in an organism, and yet it is not good. Or they call into question the concept of nature that is a presupposition for the privation view of evil. These positions do, none the less, have a long history of support among philosophers which extends to this day, particularly among Christian authors. It does, indeed, make sense to argue that everything a good, omniscient, and omnipotent God creates is good, while evil is simply a lack brought about by processes in which the good God has decided not to interfere. Apart from Augustine, Aquinas, and Suárez, this kind of defence is found among neo-Scholastics such as Jacques Maritain and Etienne Gilson and is widely discussed by contemporary philosophers of religion such as Alvin Plantinga, John Hick, and James Ross.

3. Good and Evil as Types of Being. The third view of good and evil has also been very popular in the history of philosophy, although it is subject to various interpretations. All its versions hold that good and evil are types of being, but some go on to interpret the being in question as a substance, while others think of it as a feature and still others as a relation.

a. *Good and Evil as Substances.* As substances, good and evil are seen as independently existing entities that are neither predicable nor part of any other entity. Most of those who argue in this way identify good and evil with ultimate principles of reality, as the Manicheans did. Christian monotheists, on the other hand, like the ones already mentioned, identify the good with God, but reject the substantiality of evil. Platonists also, whether Christian or not, seem to favour this view, but vary in their interpretation of good; some of them, like Philo (*c.* 25 BC–*c.* 54 AD) and the Pseudo-Dionysius (6th century), incline to a conception of it as divinity, while others, as Plato himself probably did, think of it rather as a form. In either case, however, the goodness of things other than that of the supreme good is understood to be derived, a copy of the ultimate good. Indeed, the basic argument in support of this view is that unless there is a substantial good which is good in itself, there would be no way to explain the accidental goodness of the things found in experience.

The problems with the substance view of good and evil as presented turn on the relation of the substance-good and substance-evil (1) to the good and evil of the things of this world and (2) to each other. For, if good and evil are substances, (1) how can they characterize in turn the substances of the world of experience, and (2) how can they relate to each other? Difficulties in finding acceptable answers to these questions have led supporters of this position to adopt various modifications of it by combining it with other ontological characterizations of good and evil. For example, many of those who accept the substantiality of good adopt also the doctrine of good as a transcendental attribute of being and the doctrine of evil as privation. This is in fact the standard combination adopted by many Christian philosophers, including most of those already mentioned.

b. *Good and Evil as Features.* Good and evil have also been interpreted as features of things, although this view, too, takes different forms. The most well known of these interprets good and evil as qualities. Thus, for example, G. E. Moore argued, against what he regarded as naturalistic definitions of good, that good is an indefinable, *sui generis* quality, like yellow, that good things have (*Principia Ethica*, 1903). How these qualities come to be in things is, of course, a matter that requires discussion, but one which is only indirectly related to the present subject matter, since in fact it concerns the causes of good and evil rather than their ontological status.

Most objections against this position centre not on the ontological character of good and evil themselves as qualities, but on how we come to know which things have these qualities. For many of those who adopt this position adopt also the view that, just as yellow is sensed, so good and evil are intuited. Some people are blind and cannot see yellow, while others can. Likewise, some people intuit what is good and evil, and others do not. Obviously, this intuitionist approach, favoured among others by Moore himself, as well as by other objectivists like Max Scheler (1874–1928) (*Der Formalismus in der Ethik und die materiale Wertethik*, 1913–16) and Nicolai Hartmann (1882–1950) (*Ethik*, 1926), creates difficulties for the quality view of good and evil and has led some of its supporters to develop other versions of the view supposedly immune to this attack. For example, Risieri Frondizi (*What is Value?*, 1963), following Christian von Ehrenfels (1859–1932) (*Grundbegriffe der Ethik*, 1907) and others, argued that all value is a Gestalt quality, a position that, with modifications, has been recently defended by R. Chisholm and R. Nozick. The introduction of the notion of Gestalt is supposed to allow the settlement of disagreement about whether something is good or evil, thus removing the intuitionist component of the pure quality view.

c. *Good and Evil as Relations.* More popular even than the substance and feature views is the relational view of good and evil. It usually comes in two versions: (i) one interprets good and evil as conceptual relations, while (ii) the other conceives them as real relations.

(i) Conceptual relations. The first position, which is generally favoured by radical empiricists, holds that good and evil are nothing more than, say, a matter of emotional responses to how we perceive things and/or feel about them. There is nothing in things that may be called good, and which causes desire to arise. Goodness is in fact the conceptual and/or emotional perspective of subjects when they regard something as desirable. Strictly speaking, then, when one calls something 'good' or 'evil', one is describing a mental phenomenon or attitude in a subject toward an object, that is a relation of a subject to an object, rather than something real in the world independent of the subject. Accordingly, propositions of the form '*X* is good (or evil)' are descriptively inaccurate, and must be translated into propositions of the form '*Y* thinks that *X* is good (or evil)' or '*X* appears good (or evil) to *Y*'.

This sort of view is frequently regarded as a form of subjectivism, since it reduces the value of an object to the way in which the subject perceives it or, as R. B. Perry (1876–1957) (*General Theory of Value*, 1926) would have put it, to the interest the subject takes in it. Many emotivist views of value, and those that reduce value to commendation, etc., can be interpreted as falling into this general category, even though most authors accused of this fault, like A. J. Ayer (1910–88) (*Language, Truth and Logic*, 1936) and Charles Stevenson (*Fact and Value*, 1963), try to disassociate their positions from strict subjectivism in various ways.

The view that good and evil are conceptual relations neglects the intention that accompanies axiological propositions and, because of it, has been considered objectionable by many philosophers. None the less, many contemporary authors, like R. M. Hare (*The Language of Morals*, 1952), still maintain versions of it.

(ii) Real relations. The second version of the relational view to which reference has been made holds that good and evil are real rather than conceptual relations. Good and evil, according to this position, are not simply

the way we perceive or feel about things. There is in things something that serves as a foundation for regarding them good or evil, but that something is not a feature they have. Sisterhood, for example, is neither a concept in the mind of someone who perceives that Leticia and Clarisa are sisters nor is it a feature of Leticia and Clarisa considered independently of each other. Rather, sisterhood is an actual way in which Leticia stands toward Clarisa, and vice versa, regardless of what anyone may think. Likewise, good and evil are real ways in which things stand toward each other. Thus, for example, hemlock is bad for human beings while wine is good, but neither of them is good or bad in themselves; nor is their goodness or badness a matter of perspective or attitude.

This view represents one of the weakest forms of objectivism and, consequently, has often been considered a halfway house between objectivism and subjectivism. It appears in a variety of forms. Among contemporary authors who seem to have favoured versions of it are A. N. Whitehead (*Process and Reality*, 1929) and A. C. Ewing (*The Definition of Good*, 1947). The strength of the position lies in that it conceives good and evil as something real, while at the same time preserving their relational tie to the evaluating subject. Still, many find the position unsatisfactory, for the subject's desire or aversion, although connoted by the terms that express the relations, are not, as the most recalcitrant subjectivists would want, the objects of denotation. And objectivists in turn criticize the fact that in this position good and evil are not real features in good and bad things, but merely relations.

4. Good and Evil as Collections. Finally, we come to the last of our four views of the ontological status of good and evil. According to it, good and evil are nothing but the collections of good and evil things. There are no relations, features, substances, attributes, or privations that may be identified with good and evil. There are only good and evil things.

As described, this view has frequently been found unacceptable, if for no other reason than the fact that there are, in addition to good and evil things, mental phenomena through which we relate to those things. The given position is, for this reason, usually combined with the view that interprets good and evil as conceptual relations. The terms 'good' and 'evil' are taken to refer, accordingly, either

1. to particular good and evil things belonging to the collections of good and evil things in the world,

or

2. to certain mental concepts and/or attitudes.

Still, whether considered alone or as combined with the conceptual relation view, many philosophers find difficulties with this position. The difficulties usually have to do with the following:

1. the lack of an objective foundation for value judgements implied by this view,

and

2. the lack of an adequate causal explanation of what makes things good or evil.

Indeed, it does not make sense to say that things are good and evil simply because they belong to a collection, since belonging to a collection does seem to imply that there is something common to the things belonging to it. But if that is the case, then good and evil must be more than the collections of good and evil things and there must be causes or principles of the good and evil in things.

See also: **Good**

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JORGE J. E. GRACIA

Grammar
I: History

Teaching and research in grammar throughout the world is now the product of rather more than 2000 years of continuous thought, extending from ancient Greece to linguists at work today. This tradition has been influenced and enriched by successive contacts with grammatical studies in other civilizations, principally Arabic and Hebrew from the early medieval period, Chinese scholarship from about 1600, and, most important of all, the renowned products of the Sanskritic grammarians in ancient India in the first millennium BC, which became fully known in Europe from the end of the 18th century.

Grammatical studies in Greece arose from two sources. Philosophers had brought questions relating to the Greek language into their speculations since pre-Socratic times. A Socratic dialogue, the *Cratylus*, was devoted to the origin and nature of language, and various statements of grammatical analysis appear in the works of Plato and Aristotle. But it was the Stoics who formally assigned a specific place to the study of language within philosophy, in their belief, shared by the Chomskyans today, that through an understanding of language we can attain to a uniquely penetrating insight into the nature and the operations of the human mind.

A second and quite separate motivation appeared in the Hellenistic age, when as a lasting result of the Macedonian conquests, the Greek language, Greek literature, and Greek civilization were officially imposed on large areas of Asia Minor and Egypt, a cultural situation persisting right through Byzantine times and only checked by the Arabic and Turkish conquests. This Hellenization required the explicit teaching of Greek as a foreign language, and cities such as Alexandria and Pergamum became centres for continuing linguistic and literary research and advanced teaching.

Linguistic work continued throughout pagan antiquity among the Stoic philosophers, but the literary and didactic orientation of grammatical studies became and remained the dominant one in the Greek world and among the Romans, who as in so much else were always eager to follow and adapt the ideas of the Greeks. The conversion of the Roman Empire to Christianity did not make a great difference here, except that Christian texts were added to and in some cases substituted for the earlier classical literature. We have a number of extant Latin grammars written in late antiquity and the early Middle Ages, all following much the same lines, the best known being those of Aelius Donatus (fl. 4th century) and Priscian (*c.* 500), whose very comprehensive grammar became the standard medieval authority.

The study and teaching of Latin grammar was firmly secured in medieval scholarship, both by the practical need for any educated person to know and to use Latin in much of his daily life and work, and by the place of grammar as one of the Seven Liberal Arts, which formed the content of all post-primary education, grammar being, in fact, the basic component of the *Trivium*.

The first major change in grammatical thinking came in the scholastic age in the later medieval period. This change centred on the University of Paris and arose from a number of sources. These included developments in logic in the 10th and 11th centuries, the rediscovery by the West of the major philosophical writings of Aristotle, and the growing desire of commentators on Priscian to explain and to justify his form of grammatical presentation, as against the practice of earlier commentators who were primarily concerned with summarizing his work and making it easier of access to teachers and students.

At its height in the 13th and 14th centuries this movement led to the production of grammars quite divorced from the requirements of Latin teaching and literary appreciation. Grammar was now integrated into a unified, largely Thomistic, conception of the world, in which reality as created by God, human reason as given by God to mankind, and the grammatical structure of language were all congruent in their basic concepts, ultimately derived from Aristotelian logic and metaphysics, which the scholastic age found quite compatible with the tenets of the Christian faith. One implication of this view, explicitly stated at the time, was that the underlying grammar of all languages was

one and the same, the individual differences in the sounds and in the lexical forms of actual languages, however inconvenient, being mere 'accidents' and of no scientific or theoretical importance. Though these scholastic grammars were written in Latin and on Latin, and derived from Priscian, perhaps their most important legacy has been the notion of universal grammar, or linguistic universals, as a permanent focus of research and inquiry.

Scholastic grammar could not survive after the demise of scholastic philosophy as a whole, and from the 15th century it fell under attack from various quarters. Philosophically the tripartite system of reality, thought, and language was rejected by the nominalists; and the humanist revival of classical studies returned the attention of linguists to the Latin of Cicero and Vergil (and to the Greek of the Greek authors) and led to the rejection of what was now considered the dry, artificial, and inelegant Latin of the scholastics. The rise in status in the Protestant churches and among the middle classes of the spoken languages of Europe drew more effort towards the grammatical study of modern languages, an interest reinforced by the discovery of languages outside Europe, such as Chinese on the one side and the native American languages on the other, exhibiting forms and structures hitherto unknown and unsuspected by European scholars.

Philosophical grammar, however, went on alongside these new developments. The contrasting terms *grammatica philosophica* and *grammatica civilis* came into use to distinguish theoretical grammar on the one hand from practical and literary grammar on the other. Universal grammar remained a centre of attention, but its justification came to rely more on the 'laws of thought' or the supposed working of the human mind than on an all-embracing scholastic conception of reality. An interesting contrast is seen between these two attitudes in 17th-century France. Attempts were made to formulate rules governing the use of relative pronouns referring to nouns appearing in certain constructions without a definite article. Claude Favre Vaugelas (1585–1650) explained in his *Remarques sur la langue française* that he had arrived at his rules by careful collection and comparison of examples from French literature and from the usage of speakers of the upper classes and of court circles. Two grammarians of the Port-Royal School, which concerned itself with the study of logic, accepted his statements as correct but sought to base them, not on usage and literary evidence alone, but on the grounds of certain fundamental concepts of the mind such as determinacy and indeterminacy. This is just one case. The basic contrast between these two attitudes to grammar has continued to the present day. In general the philosophical grammarians have sought support in the rationalist tradition in philosophy, and the practical grammarians are strongly influenced by empiricist doctrines, though it must be stressed that rationalism and empiricism represent varying degrees along a scale rather than mutually exclusive epistemological positions.

During the 19th century, partly as the result of the 'discovery of Sanskrit' and of its historical relations with the classical and with most of the modern languages of Europe, and partly as a product of historicist and nationalist emotions arising in the Romantic age in Europe, historical linguistics, 'comparative philology', came to dominate linguistic studies, though, of course, theoretical grammar continued to be taught and researched. Indeed, the detailed excellence of the ancient Indian linguists' grammatical analysis of Sanskrit, of which Pāṇini's grammar is the best known, led to a remarkable refinement in the morphological analysis of word structures in European languages.

Philosophically, historical linguistics, being dependent on the careful gathering and comparing of evidence from the forms of different languages, living and dead, was empirically directed, observed data being regarded as the foundation of knowledge, with no speculative assumptions being made about universal grammar and the working of unobservable human minds. This empiricism persisted through the first half of the present century in the revival and the ultimate dominance of descriptive linguistics at the hands of such linguists as Leonard Bloomfield (1887–1949), unwitting founder of the once most

influential 'Bloomfieldian' school of linguists. Since 1957 a fundamental change has occurred, again comparable to that brought about by the scholastic philosophical grammarians. This resulted from the work of Noam Chomsky, who with his large number of adherents has effectively developed and defended a rationalist approach to linguistics in contrast to the strong empiricism of the Bloomfieldians. Though some people continue to speak of the 'Chomskyan revolution', Chomsky himself constantly appeals to 17th- and 18th-century rationalism for support in the theory he is defending and developing.

In arguing his case Chomsky repeatedly draws attention to the facts of first language acquisition in early childhood, completed in its essentials without self-conscious learning or explicit teaching. This, he maintains, is only explicable if we assume that the part of the brain responsible for language is not the *tabula rasa* of the empiricists but a highly structured and constrained set of genetically inherited patterns and restrictions on the forms that a grammar can take. These are analogous to the classic 'innate ideas' of the 17th-century rationalists and they are the basis of universal grammar, which in Chomsky's view is a main key to our understanding both language and the working of the human mind or brain.

In considering the extent to which there may be valid links to be drawn between grammar and ontology, between the forms and structures of grammars, and the forms and structures of the existent world, one must keep in mind the distinctive approaches to grammar noticed in the preceding paragraphs. There is an undeniable connection between entities perceived or assumed to persist through time, *man, table, sun, house, illness, health, wisdom, folly, beauty, courage*, etc., and time-bound activities or states in which persistent entities engage or through which they pass, *revolve, kick, hear, eat, fall, recover, teach, learn, climb, be happy, grieve*, etc. Such a dichotomy is ragged at the edges and may vary from language to language, but is generally mirrored in the grammatical dichotomy of nouns and verbs and in the most basic of sentence structures, *noun*, or *noun phrase* + *verb* or *verb phrase*, not necessarily in that order or in any specific order: *the sun is setting, the chair broke, his health returned, Romani Cathaginem vastaverunt, seges est ubi Troia fuit, nun wird der Mond hell sein*, etc.

Along with this rather general correspondence, most grammarians would identify in statements and questions a subject, usually a noun or noun phrase, and a predicate, usually built around a verb, and align these with the correspondingly named logical subject and predicate, and more pragmatically with what is to be talked about and what further information is to be given or requested, though there is no exact match between these three pairs.

Empirically minded grammarians and those primarily concerned with language teaching would probably not wish to go beyond such general statements. But those who look to language as a key to our minds and to our understanding of the world are obviously motivated to go further. Perhaps furthest in this direction were the late medieval scholastic grammarians, who grounded their theory of human language on a divinely ordained parallelism between three levels, existence, understanding, and grammatical presentation. Others have concentrated on connections between language and understanding (or the mind). This is essentially the case with the Port-Royal grammarians and with the Chomskyans today. While empiricism and rationalism contribute the main lines of debate today, a view of linguistics as a Platonic theory of abstract objects has been put forward by J. J. Katz; from an essentially Chomskyan starting-point, but in more traditional philosophical terms, he goes beyond the nominalism of the empiricists and the conceptualism inherent in Chomsky's rationalism to a realist theory of linguistics as being concerned with "a timeless, unchangeable, objective structure" (1981, p. 9).

So far we have been looking at some of the ways in which linguists have thought it legitimate and interesting to relate the structures and categories of grammar to the structure of the mind or of the world as understood philosophically. A reverse attitude is worth mentioning, known generally as the 'Whorf hypothesis' from the name of its proponent in its extreme and least acceptable form, but

found also in the thought of Wilhelm von Humboldt (1767–1835) and Edward Sapir (1884–1939), among others. On this approach it is the lexical and grammatical structures of a language that determine cognitive structure, and cognitive structure determines the form in which we perceive and understand the world we live in. On this basis it is argued that, so far from seeking universal grammar in a common world and a common rationality, we should recognize the somewhat different but overlapping worlds in which we live as speakers of different languages. That translation is possible between languages seems to rule out any extreme interpretation of the theory, but the fact that translation has not as yet been converted into a wholly mechanical procedure is evidence for a significant influence of language structure on some lines of thought, science, and culture. In von Humboldt's words: "the variety among languages is not that of sounds and signs, but a variety of the world-views themselves" (*Gesammelte Schriften*, vol. 4, p. 27).

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ROBERT HENRY ROBINS

Grammar II: Modern Theories

We shall restrict ourselves to the ontological import of grammar. Accordingly, we shall put aside problems connected to the formal properties of grammar, in particular what concerns their formal equivalence. Thus our discussion of grammatical theories will be limited to those which were explicitly used as a technical tool in the construction of a formal ontology.

Traditional and Modern Grammar. Grammatical studies were traditionally associated with an inquiry of metaphysical scope: think of traditional grammar, from Aristotle's *Categories* onwards. Concerning modern grammar, whose origins can be traced as far back as to the time of Port-Royal (cf. Dominicy 1984), ontological concern is unevenly shared out among various grammars. It is strong where we are dealing with general grammars, heir to the tradition of Port-Royal, weaker when the rejection of parallelism between logic and grammar is made explicit, and the way is thereby opened to a more empirically motivated study of syntax. James Harris's (1709–80) *Hermes* of 1795 is an exception here, because it brings about a synthesis of the grammatical Platonism of antiquity and the Middle Ages with the universal rational grammar of the Enlightenment.

Husserl's Pure Grammar. The fourth *Logical Investigation* of Edmund Husserl is devoted in part to the very idea of a pure grammar. Husserl here once more ties together formal ontology and pure grammar. But Husserl does not identify logic and grammar: pure grammar is, he tells us, a preliminary to logic in the general frame of a formal and general ontology. In this frame he once more takes up the classical distinction between dependent and independent or syncategorematic and categorematic expressions, a distinction which corresponds to the ontological distinction between dependent and independent parts of a whole. Husserl's pure grammar is a philosophical grammar of a categorial sort. There is a sharp contrast between traditional grammar based on parts of speech and Husserlian universal grammar based on categories. The starting-point is very simple, derived from the aforementioned distinction between categorematic and syncategorematic expressions. A category is a function which applied to a category gives a modified category: if for example 'John' belongs to the category N (of Names), and 'John runs' to the category S (of Sentences), then 'runs' belongs to a category which takes an expression of category N as argument and gives an expression of category S as value, which we can write as S/N, (N,S), or the like.

Montague Grammar. Richard Montague (1930–71), a pupil of Alfred Tarski, and through him an heir of Polish analytic philosophy, gave a very high standard of rigour to the construction of a pure, formal, and universal grammar, mainly on algebraic and logical bases (more specifically on the basis of universal algebra and intensional logic). He, too, followed the categorial track, but he introduced something radically new: the idea of a systematic matching between categories and semantic types. Montague's project, which in scope and ambition can be compared in the modern age only to those of John Wilkins (1614–72), G. W. Leibniz (1646–1716), and Johann Heinrich Lambert (1728–77), is not only linguistic; it is also the project of a formal ontology. Here, influenced by Rudolf Carnap, he defends a constructionist and reductionist position. Certainly he admitted in his ontology intensional entities, but he always took care to reduce these entities to extensional ones, exposing himself to criticism of both extensionalists and the more devout proponents of intensionalism.

The leading hypothesis of Montague's semiotics is the possibility of applying to natural languages, in strategies of translation and interpretation, the idea of a strict correspondence between syntax and semantics of the sort that is perfectly accomplished in the standard propositional and predicate calculus of the first order. This correspondence is applied to the relation between syntactic and semantic rules of interpretation. To each syntactic rule, which for a given category is defined as a certain sort of operation, there corresponds a semantic rule, which determines, with the help of quasi-Carnapian meaning-postulates, the corresponding translation of the linguistic expression into the intensional language of translation (a higher-order modal logic). Finally, the matching between syntax and semantics is based on a mathematical relation (structural homomorphism), between the syntactic algebra and semantic algebra of the two languages, the first (the language of translation, intensional logic) semantically perfect, the second (natural language, or rather a certain fragment of regimented English) semantically imperfect. A language is semantically perfect if each syntactic rule matches a corresponding semantic rule, and therefore if there is a definition of truth in this language.

The idea of semantic perfection derives from the Tarskian theory of models. The model-theoretically based semantics is a foundation for Montague's semantics of natural language. Some logicians doubt that intensional languages are semantically perfect (Donald Davidson, W. V. O. Quine) and some linguists doubt that natural language can be described in terms of semantic imperfection (Noam Chomsky). This homomorphism in the case of formal languages is already given in the theory of models, and is applied to the empirical relation between syntax and semantics of natural languages. Montague's Universal Grammar contains therefore a universal theory of translation, which guides semantic interpretation.

Some philosophers (e.g. Quine) have disputed the exact relation between interpretation and translation in semantics. Montague's theory of translation is, however, distinguished by the fact that it does away with the intuitive character of semantic interpretation such as is found in generative semantics and elementary logic textbooks, where the relation between logical form and superficial syntactic structure was grasped in a capricious way.

Properties, Types, and Meanings. The matching between syntax and semantics is identical with that between categories and types. Two primitive categories are given, *e* (for entity) and *t* (for truth value). The matching mechanism gives for each primitive and derived category an extension and an intension. The category *e* of individual terms has as extension individuals and as intensions individual concepts; the category *t* of formulas has as extension truth values (in the old-fashioned Fregean style) and as intensions propositions. The category *t/e* of one-place predicates has as extension sets of individuals and as intensions individual properties. At least two important ontological theses are hereby presupposed. First, that there are two distinct ontological operations: assignments of category (in such a way as to obey compositional criteria) and assignments of type.

The classification of categories is distinct from the ascending order of types. Second, that there are intensional entities: individual concepts, properties, and propositions.

Montague's grammar has been criticized in at least two points: the lack of flexibility in the matching between types and categories; and the need for an explicit theory of properties. Recent developments in foundational studies have touched on these two points. On the one hand there is the construction of grammatical theories admitting categorial polymorphism (Sells 1985); and on the other hand there is research into the theory of properties (Chierchia *et al.* 1989), both of which can be integrated into a totally explicit grammatical theory conserving the Montagovian postulate of matching. By 'categorial polymorphism' is meant a flexibility of categories and the introduction of rules for change of type (see van Benthem in Chierchia *et al.* 1989). These two modifications are of uneven ontological weight, but the relation between grammar and ontology will surely be affected both by categorial flexibility and by property theory.

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FRÉDÉRIC NEF

Graph Theory

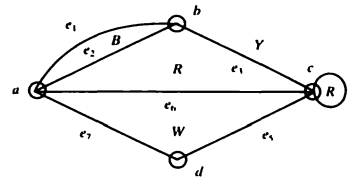
A *graph* is an ordered triple (V,E,I) such that:

(1) V,E are disjoint sets
(2) I is a subset of $V \times E$
(3) for each $e \in E$, $I \cap (V \times \{e\})$ has cardinality 1 or 2.

Without further comment it would seem that graph theory is little more than the theory of sets with almost the most minimal structure imposed. Of course, our knowledge of set theory suggests the 'little more' might indeed be a great deal. The inherent attraction of graph theory is that we can give a pictorial representation of a graph. This has proved invaluable to the development of the theory.

Elements of V and E are called respectively *vertices* and *edges*. A vertex v and an edge e are *incident with each other* if $(v,e) \in I$.

The picture below:



R = red W = white B = blue Y = yellow

represents the graph with:

$V = \{a,b,c,d\}$, $E = \{e_1,e_2,e_3,e_4,e_5,e_6,e_7\}$, $(a,e_1) \in I$, $(b,e_1) \in I$, $(c,e_4) \in I$ etc.

If 'loops' and 'multiple edges' are excluded then a graph is simply a symmetric binary relation on a set.

The Four Colour Theorem relates to *plane graphs*. A plane graph is a graph which can be drawn in the Euclidean plane without any two edges crossing. The theorem states that the map in the Euclidean plane determined by a planar drawing of a plane graph G is four colourable. This means that the regions into which G divides the plane (including the unbounded region 'outside' G) can be coloured, as indicated above, with four colours, e.g. red, white, blue, and yellow, so that each edge of G lies between two regions to which distinct colours have been assigned. One could easily argue that interest in the map colouring problem was the central reason for

the development of graph theory from its early beginnings in the late 19th century. Graph theorists are still interested in generalizations of the Four Colour Theorem and in obtaining a more intuitive proof than the algorithm proof contained in Appel and Haken (1977).

Modern research has focused on, among other topics, matchings, paths and cycles in graphs; Ramsey graph theory; extremal problems; the reconstruction problem; and the five-flow problem.

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Greek Philosophical Terminology

Technical terminology is important for any science or craft. It gives the community of practitioners a precise and rigorous vocabulary which makes relatively unambiguous communication possible. While philosophical terminology has never been completely uniform, philosophers now enjoy a relatively stable set of common terms. Our present philosophical vocabulary is a legacy of Greek philosophy. Beginning without any technical terminology and drawing only on its native resources, Greek philosophy gradually evolved a complex vocabulary which became the model for philosophical and indeed scientific terminology in all the Western languages. Thus the development of Greek terminology reveals some important relations between language and philosophy.

Although it is difficult to reconstruct vocabulary from the remains of early Greek philosophy, we can say that the first Greek philosophers used new terms only incidentally. One of the terms associated with the early pre-Socratics is ἀρχή. It is unclear whether it was first used by Anaximander (611–547 BC); but in any case it must have been used first in the sense of 'beginning', and only later in the abstract and timeless sense of 'principle'. As with ἀρχή, other terms of art in early Greek philosophy are almost always common words philosophers have co-opted for special uses or words their theory has made especially important. Terms such as δύναμις (power), ψυχή (soul), and νόος (mind) come to express important philosophical notions without changing their basic meanings significantly. A few other terms acquired new denotations as they became focal points for cosmological speculation. Thus for Heraclitus, λόγος (speech) came to denote the underlying order of nature as well as its expression in philosophy. Beginning with Heraclitus (*c.* 540–*c.* 480 BC), κόσμος (order, ornament) came to signify the finite world system consisting of the earth and its heavens. The term φύσις (birth, growth, natural form) gradually came to mean nature.

While the pre-Socratics were slowly developing a small set of philosophical terms, they did without terms for many abstract concepts that seem essential to modern philosophers. In particular it is surprising that the pre-Socratics, who were so concerned with the original materials of the world had no word for matter. Not until Aristotle adapted the word ὕλη (originally 'wood' and then 'building material, material') could the Greeks speak unambiguously of matter in general. Anaximander, however, had already conceived of a perhaps characterless original substance which he called τὸ ἄπειρον (the boundless). In reaction to his predecessors' too concrete conceptions of a basic substance, Parmenides (fl. 5th century BC) argued that there was only τὸ ἐόν (what is). Anaxagoras (*c.* 500–*c.* 428 BC) posits as changeless elements substances such as bone and hair, but he gives the class no name. Empedocles (*c.* 490–430 BC) posits four unchanging elements, calling them metaphorically ῥιζώματα (roots). His elements are the familiar substances earth, water, air, and fire; but for literary reasons he varies his

terms for all of the elements, for instance calling fire by five other names than πῦρ, including the names of Zeus and Hephaestus. The one pre-Socratic who consciously developed terms of art was Democritus (*c.* 400–*c.* 370 BC), who explained that atoms differ from one another by ῥυθμός, διαθιγή, and τροπή ('rhythm', i.e. shape; 'touching', i.e. order; and 'turning', i.e. position). He seems to have carefully chosen his words to stress the concrete as against the abstract and the spontaneous as against the organized.

Some Sophists, and notably Prodicus, emphasized ὀρθοεπεία (correct diction) as a means of improving rhetoric. Although they may have furthered grammatical studies and encouraged attention to semantics, the Sophists made no lasting contributions to philosophical terminology. Both Socrates (*c.* 470–399 BC) and Plato stressed the importance of discussion to philosophy while distrusting technical terminology. Yet the novelty of Plato's philosophy forces him to express himself in new ways. For instance, he explains in the *Phaedo* that the many beautiful things are beautiful by partaking (μετέχειν) in beauty. But then he points out that the relationship between the particulars and the Forms can be called παρουσία (presence) or κοινωνία (communication) or something else. In general he sees language as inadequate to represent reality; thus to adopt a rigid terminology could only mislead us into thinking we have a grasp on reality through language.

Typically Plato creates not new words but new meanings for old words, as K. von Fritz (1938) points out. To refer to his Forms, he borrows the non-technical terms εἶδος, ἰδέα, signifying form, shape, or figure. He uses the term οὐσία (possessions, property) in the etymological sense of being or essence, and contrasts it with πάθος (affection) to provide the first rudimentary substance–accident distinction. He does create a few new words such as ποιότης (quality) and ἐναντιότης (opposite). However, in many other situations that might seem to demand technical terms for clarity, Plato supplies neither new terms nor new meanings of old terms. Thus in the *Protagoras* he distinguishes between parts that are qualitatively alike and those that are qualitatively unlike, with no generic terms for the two classes – which Aristotle will call τὰ ὁμοιομέρη and τὰ ἀνομοιομέρη, homogeneous and non-homogeneous substances, respectively. In the *Euthydemus* he distinguishes between possessions and their use – anticipating Aristotle's distinction of state (ἕξις) and activity (ἐνέργεια) – again without using general terms. And in the *Sophist* Plato distinguishes for the first time between idealists and materialists by comparing their disagreement to the mythical battle between gods and giants. In general Plato tends to make only *ad hoc* distinctions and to avoid using special terms.

It is Aristotle who provides the great impulse toward technical terminology. His ideals of scientific rigour and precision demand exact terminology. In sharp contrast to Plato, Aristotle makes distinctions that will have universal applications. Thus he does not confine himself, like Plato, to occasional observations about logical relationships, but rather he develops a whole system of logic together with a theory of proof. As the creator of the first logic, he invents also the terminology of premiss, conclusion, syllogism, conversion, etc. He freely creates new terms in all fields, sometimes, like Plato, reusing old words in new senses. Thus κατηγορία (in common usage 'accusation') he uses in its pregnant meaning of 'saying of' to mean 'predicate, predication'. He also takes over Plato's οὐσία to signify his central metaphysical notion of 'substance'. But Aristotle goes on to coin many new words, sometimes by using a descriptive term in a specialized way, as with ὑποκείμενον ('substratum', literally 'underlying') or by creating new compounds such as ἐνέργεια (activity, actuality). Besides more conventional compounds Aristotle often makes single terms out of phrases or uses whole phrases as terms. Thus he creates the word καθόλον (universal) from καθ' ὅλου (as a whole), and uses the phrases τὸ τί ἦν εἶναι (essence), τὸ κατὰ συμβεβηκός (accident), τὸ πρός τι (relative), and τὸ οὗ ἕνεκα (that for the sake of which) as set terms.

Aristotle was not only interested in inventing new terms for philosophical concepts. He also was concerned to disambiguate existing

terms. He recognizes relations of synonymy and homonymy – relations holding between things, not words. Synonymous things are called by a name that has the same meaning, and hence share a common property or nature; for instance man and horse are both animal. Homonymous things are called by a name that has a different meaning as applied to the respective things, and hence they do not share a common nature signified by that name, for instance a dining-room table and a multiplication table. Some homonymous things, however, presuppose a single central notion; for instance a healthy complexion and a healthy food are both defined in terms of health. Thus some homonymous things are related obliquely to one another. Aristotle uses his theory of meaning to define various philosophical terms. Most notably, Book V of the *Metaphysics* is a philosophical lexicon designed to clarify his own terminology.

Part of Aristotle's programme of instituting a rigorous language consists in his systematizing terms. Where previous philosophers had been content to make intuitive distinctions between contrasting terms, Aristotle creates a tree of precise classifications. The most general classification is into ἀντικείμενα (opposites) comprising four subclasses: τὰ πρός τι (relatives), τὰ ἐναντία (contraries), τὰ κατὰ στέρησιν καὶ ἕξιν (privation and possession), and κατάφασις and ἀπόφασις (affirmation and denial) (*Cat.* 10). By ordering opposites in this manner Aristotle is serving notice that he will henceforth observe this technical classification. He can thus assume a certain background knowledge about each class of opposites without restating his distinctions.

Later Greek writers could build on Aristotelian terminology in developing their own philosophical vocabularies. For instance the Stoics used Aristotle's terms for substance, matter, and predication in developing their own theories. The Stoics felt compelled to develop their own account of categories, which though different was still inspired by Aristotle's account. Their own intense interest in epistemology led them to develop a complex vocabulary of epistemological terms such as ἔννοια (thought), ἐννόημα (concept), πρόληψις ('preconception', a term Chrysippus borrowed from Epicurus), τύπωσις (impression), and κατάληψις (comprehension). In logic the Stoics recognized meanings (λεκτά) as entities. In ethics they stressed duty (τὸ καθῆκον) in the context of living in accordance with nature (τὸ ὁμολογουμένως ζῆν).

Their value theory recognized the indifferent (ἀδιάφορον), lying between the absolutely good and the absolutely evil; and the indifferent included what was to be preferred and what was to be rejected (προηγμένα, ἀποπροηγμένα), i.e. the relatively good and evil. For the Stoics, only virtue was absolutely good, but for instance health and wealth were to be preferred to poverty and sickness. Thus Stoic terminology recognizes both moral and non-moral goods but clearly subordinates the latter to the former. Many modern terms owe their origins to precise Hellenistic distinctions in logic, epistemology, and ethics.

The attempt to philosophize in Latin was largely the attempt to introduce Greek concepts into Latin. The pioneers of Latin philosophy, however, were not so much translators as popularizers. Lucretius (*c.* 99–55 BC), Cicero (106–43 BC), and Seneca (*c.* 4 BC–*c.* 65AD) all enriched Latin vocabulary with philosophical terms as they made Greek theories available to a Roman audience. Cicero often gives explicit equivalences between his Latin terms and their Greek originals, but his translations remain *ad hoc* and unsystematic. For instance in one treatise he translates a single Greek phrase by at least eighteen different Latin expressions. Evidently he is more interested in evoking the Greek idea than in replacing it with a technical equivalent. Moreover, he does not translate Greek works into Latin, but only provides the verbal resources in Latin for discussing works one must read in Greek – if one wishes to be more than a dilettante. Thus early Latin philosophy remains parasitic on Greek thought. Yet despite their limited ambitions, the early popularizers provide a rich vocabulary especially of ethics and epistemology. Thus Cicero translates Plato's four cardinal virtues as *sapientia*, *temperantia*, *fortitudo*, and *iustitia*, chooses *vitium* (vice) to render κακία, and gives us *comprensio* for

the Stoic κατάληψις. He also provides basic metaphysical terms such as *forma, materia* (originally 'wood' like its Greek counterpart ὕλη), and (according to Seneca) *essentia* (cf. οὐσία). Seneca first uses the term *substantia*, apparently modelled on the Greek ὑπόστασις (reality, substance).

When Christianity became the dominant spiritual force in the Roman Empire, it brought with it new concepts from the Judaic tradition (e.g. sin and atonement) and from primitive Christianity (e.g. faith, hope, and charity), and new theological terms from the Greek fathers (e.g. ὁμοούσιος (of the same substance), from the Nicene Creed). Augustine founded the Christian philosophical tradition for the Latin-speaking world by combining elements of Greek – especially Neoplatonic – philosophy with doctrines of Christian faith. Thus he held that the essences of things existed externally as ideas (*rationes*) in the mind of God. In the wake of barbarian invasions, the western half of the empire lost touch with the Greek language and Greek learning. The early Latin Middle Ages depended heavily on Augustine for a knowledge of classical theories, and knew Aristotle only through a few translations Boethius had made. But by his translations and commentaries Boethius set the basic terms of Latin metaphysics. He distinguished *substantia* from *accidens* and *universale* from *particulare/singulare/individuum*. Philosophers of the 10th and 11th centuries began to develop new terms to deal with the problem of universals, a problem raised but not settled by Boethius.

In the 12th and 13th centuries Aristotle's works were translated into Latin from Arabic and Greek texts. The new translations effectively brought the best of Greek philosophy into the Middle Ages. Greek terminology, now rendered into Latin, continued to be important no doubt because Aristotle's philosophy continued to be important. The Scholastics valued the precision of Aristotle's terminology and sought to supplement it with distinctions of their own creation. Thus Thomas Aquinas distinguishes between 'signate' and 'non-signate' matter (i.e. matter with and without determinate dimensions), and between an analogy of proportion and an analogy of proportionality. He identifies *universalia ante rem, in re*, and *post rem* to help resolve the problem of universals. Whereas Latin had once been poor in abstract terms, it was now rich. Scholastic terminology became the basis for philosophical terminology in the emerging vernacular languages of Europe.

What emerges from this brief overview is the fact that Greek technical terminology arose only as Greek philosophy matured. When philosophers did seek fixed terms they had at their disposal a highly flexible medium for expressing complex ideas. But the Greek language itself was not the moving cause of philosophical progress. For philosophy had flourished long before the Greeks had any set technical vocabulary or any particular interest in language. A study of Greek philosophy thus provides no evidence for Martin Heidegger's famous claim that Greek is an especially philosophical language. The Greek language did not in any important sense make philosophy necessary or even possible. But the growing complexity of philosophical thought did in a certain sense make technical terminology necessary.

It also appears that once a rich and complex technical terminology develops, it is in general easier to modify that terminology than to abandon it completely. New philosophical theories lead to new terminology. But they also grow out of old theories expressed in old terminology. While it is dangerous to put new wine in old bottles, it is difficult to make new bottles. Hence we note a tendency to reuse old terms in new senses. Aristotle's forms are quite different from Plato's, and René Descartes's substances are quite different from Aristotle's. Yet such basic metaphysical terms remain surprisingly constant. T. S. Kuhn has noted that during times of revolutionary change in science it is difficult for rival factions to argue with each other because they use the same terms in radically different ways. For instance, prior to Copernicus (1473–1543) a planet is a wandering star; after Copernicus, a planet is a satellite of the sun. In the same way radical changes in philosophical theory are sometimes reflected more in changing meanings of terms than in new terminology. Thus Christian philosophy differs radically from

classical philosophy by positing the creation of matter *ex nihilo*, and by allowing for the possibility of prime matter existing without an inhering form. Yet the notions of matter and prime matter are both to be found in Aristotle. Descartes makes a revolutionary distinction between mind, as thinking substance, and matter, as extended substance. Yet his terminology is perfectly comprehensible to a scholastic philosopher. What is new is the claim that mind and matter are separately existing substances and not respectively formal and material causes of a concrete substance.

In metaphysics the Greeks' most important legacy was the theory of substance. Aristotle claimed that the perennial question of metaphysics, 'What is being?' was just the question 'What is substance?' (*Met.* 1. 1028b2–4). On a broad construal of 'substance', Aristotle could reasonably claim that philosophers from the earliest pre-Socratics on were attempting to understand substance. Aristotle's notion of substance survived into the early medieval period in Latin and Arabic philosophy, when it existed side by side with the incompatible Neoplatonic ontology of hypostases. Scholastic philosophy returned to a more consistent Aristotelian ontology, but Neoplatonic elements remained, such as the notion of the Mind of God as a receptacle for Platonic Forms. In the modern era the theory of substance underwent drastic transformations: Descartes's bifurcation of nature in mind and matter, Spinoza's invention of a single, all-encompassing substance, and Leibniz's invention of atomic spiritual substances called monads. But while the Continental philosophers were desperately redesigning substances to answer the mind–body problem, the British empiricists were questioning the whole notion of substance. Ultimately David Hume's attack proved fatal. But clearly the notions of substance, form, matter, essence, accident, property, subject, predicate – in short, the theory of substance with its associated terminology – dominated metaphysical thought up to the time of Kant, who himself made a place for substance in the pure concepts of the understanding. Thus it was relatively late in the history of Western philosophy that alternative ontological theories appeared. Hume hinted at an ontology of events; H. Bergson and A. N. Whitehead developed ontologies of processes; Bertrand Russell and Ludwig Wittgenstein argued for ontologies of facts. But these alternative ontologies were largely reactions to substance theory, and often expressed in terms borrowed from substance theory, such as 'property' and 'particular', or Wittgenstein's *Form* and *Substanz*.

The Greeks began philosophizing before they had an effective vocabulary for expressing their abstract thought. They invented a language for philosophical discourse – haphazardly at first, and then deliberately. Their terminology embodied a wealth of subtle distinctions which reflected a powerful conception of the world. That conception, modified by Christian faith and certain eclectic borrowings, dominated Western philosophy until recent times. The language of substance became the common heritage of Western thought, and, surviving the demise of substance theory itself, helped to provide the vocabulary of successor theories. Indeed modern physical science borrowed many of its technical terms from Greek philosophy, terms such as 'energy', 'potential', 'force', 'matter', and 'atom'. And of course these and other terms with their origins in Greek philosophy have enriched our everyday vocabulary. In retrospect we can say that in their quest for philosophical understanding the Greeks first learned how to think abstractly and universally, and having learned, bequeathed to future generations the linguistic tools to continue their quest.

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Gregory of Rimini

Gregory of Rimini (born in Rimini *c.* 1300, died in Vienna 1358), a member of the order of Augustines, delivered lectures on the

Sentences – the theological handbook compiled by Peter Lombard (*c.* 1100–*c.* 60) about 1158 – at Paris in 1343–4. Although he had a forerunner in Adam Wodeham (*c.* 1298–1358), and possibly others, Gregory is usually considered as the most typical advocate of the doctrine of the *(tantum) complexe significabile*, that is, of something that can be signified only in a complex or propositional manner. This doctrine is upheld against those who regard the object of knowledge and assent either as the act of propositional conception or as the external thing at which that act is directed.

For Gregory, the object of assent is a *complexe significabile*, which is at the same time the total and adequate significate of a proposition or declarative sentence and also a bearer of truth-values. Though a *complexe significabile* or, as he also frequently calls it, an *enuntiabile* or statable, has a truth-value only in a derivative sense: it is true if the corresponding proposition is true or would be true if it existed, and it is false if the corresponding proposition is false or would be false if it were formed.

According to Gregory, a *complexe significabile* or *enuntiabile* is not an entity in the sense of a substance or accident; it cannot be subsumed under one of the Aristotelian categories. Rather, it is of such a nature that it includes a kind of complexity which is the correlate of the *complexio* or predication that is a constitutive feature of a propositional conception. It is a way things are in the world that is exactly parallel to the way they are represented in a mental act of compounding or dividing. Just as the syncategorematic act of the copula determines the essential form of a proposition, so the adequate significate of a proposition has the peculiar complexity of a state of affairs that can be grasped only by a compounding or dividing conception. Moreover, as the copula indicates time, Gregory projects also this feature of the propositional sign into the mode of being of its adequate significate. Differences in the tense of the copula yield different statables, namely, past, present, and future ones. Consequently, the truth-value of a *complexe significabile* may change. For example, the statable that Christ is not risen from the grave was true before the Resurrection, but it ceased to be true and began to be false at the moment of the Resurrection.

While a state of affairs as that which fits only a propositional conception cannot be an entity in the sense of an actual substance or accident, there are other senses of such words as *aliquid*, *res*, *ens* in which they do apply to it. In their most general sense, such words as 'something' and 'entity' can be used for everything that is signifiable in an incomplex, non-propositional way or signifiable in a complex, propositional way, both truly and falsely. It is in this broad sense that false as well as true statables have some kind of being. Moreover, there is a narrower sense in which those words apply to everything that is signifiable in an incomplex manner and to everything that is signifiable in a complex manner, but only truly. In that latter sense, only a state of affairs which really obtains is called an *ens* or something that is the case. To false statables, therefore, the words 'something' and 'entity' are applicable only in their broadest sense, whereas to true statables they are applicable both in the broad sense and in the narrower sense.

The type of being characteristic of *complexe significabilia* is quite independent of the acts of conceiving that may be contingently directed at them. Even before the creation of the world it was true that the world would exist and even after the disappearance of the world it will be true that the world has perished. Gregory suggests that in such cases the truth of the statables is grounded in God, the uncreated truth which is the true assent to all statables. There is, then, a realm of statables or only propositionally expressible states of affairs that exist in their own peculiar way and remain identical through the varying acts by which they are known, believed, or asserted by different persons at different times and places. It was mostly this version of logical realism defended by Gregory of Rimini that was made the object of various criticisms by those late-medieval authors who were less generous in their ontological assumptions and regarded Gregory as a thinker who multiplied entities without necessity.

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GABRIEL NUCHELMANS

Grelling, Kurt

Kurt Grelling was born in Berlin on 2 March 1886. He studied mathematics, physics, philosophy, and political economy at the Universities of Freiburg Breisgau, Berlin, Lausanne, Munich, and Göttingen.

At that time he was adherent of the Neufries'sche School highly influenced by Leonard Nelson. With Nelson, Grelling wrote the famous article "Bemerkungen zu den Paradoxien von Russell and Burali-Forti" (published in the *Abhandlungen der Fries'schen Schule* NF 2 (1908), pp. 217–26), in which the then known logical antinomies were analysed and a general scheme for their derivation was developed. This article introduced also the so-called *Grelling paradox* concerning the property of being heterological.

In 1910 Grelling took his doctor's degree in mathematics with David Hilbert. From 1924 to 1933 he taught mathematics and physics at a school in Berlin. He did scientific research as well and also translated some of the main works of Bertrand Russell into German.

In the 1920s Grelling turned to logical empiricism and became a member of the *Gesellschaft für empirische* (after 1931 '*wissenschaftliche*') *Philosophie*.

In 1939 he fled from Berlin to Brussels. After the invasion of Belgium by the Germans in 1940 Grelling was expelled as an undesirable alien to France and there interned. On 16 September 1942 he and his wife Margaret were deported to Auschwitz, where they are presumed to have been murdered on 18 September 1942.

Beside the above-mentioned paradox, the joint contributions of Grelling and Paul Oppenheim (1885–1977) to the formal analysis of the Gestalt concept (collected in Smith 1988) are of special philosophical interest. Grelling and Oppenheim here sought to reconstruct the Gestalt concepts used in psychology in a logically precise manner.

The authors recognize that 'Gestalt' is used with at least two different meanings. A Gestalt in Christian von Ehrenfels's sense is a property of wholes which satisfies both of the so-called *Ehrenfels Criteria*, i.e. the *non-summativity criterion* ("The whole is more than the sum of its parts") and the *transposability criterion*, which states that a Gestalt remains invariant under certain transformations.

On the other hand, a Gestalt in Max Wertheimer's and Wolfgang Köhler's sense – called 'determinational system' ('*Wirkungssystem*'), 'dependence system', or 'functional whole' by Grelling and Oppenheim – is a system whose elements stand to each other in relations of mutual causal dependence and fulfils only the summativity criterion. The definitions of 'Gestalt' and 'functional whole' given by Grelling and Oppenheim are intended to capture these differences.

In the case of Gestalten in the sense of Ehrenfels, Grelling and Oppenheim first introduce the notion of *transposition*. A transposition is a transformation of an object which preserves the structure of the object undergoing the transformation.

The *Gestalt* of an object with respect to certain transpositions is then defined as the invariant under these transpositions. Gestalten as here construed fulfil the criterion of transposability by definition.

As regards the views of Wertheimer and Köhler on Gestalten, here the definition of 'functional whole' is based on a concept of dependence.

Let F be a class of functions. A function f *depends* on F iff f has the same value for any two arguments for which each element of F has equal values, i.e. iff it holds for each f_i in F, that if $f_i(x) = f_i(y)$, then $f(x) = f(y)$. F is *interdependent* iff each element f of F depends on $F-\{f\}$.

A class F is a *dependence system* or *functional whole* if F is *causally* interdependent.

Grelling and Oppenheim take in this context the criterion of non-summativity to mean that, when comparing a functional whole with its corresponding aggregate, it can be seen that the former is richer to the extent of a dependence relation. This criterion is then satisfied by a functional whole, for an aggregate is characterized by the absence of any causal dependencies between its elements.

The studies of Grelling and Oppenheim served as a point of departure for further analyses in Rescher and Oppenheim (1955) and Simons (1987).

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HEINRICH KEHL

Guise Theory

Guise theory is a complex and far-reaching theory on mind, language, and reality. It has been developed by Hector-Neri Castañeda and expounded by him in numerous papers. The first unitary exposition is in Castañeda 1974, although the name 'guise theory' is only used in subsequent works.

Typical problems that guise theory was designed to cope with include Gottlob Frege's paradox of reference and Alexius Meinong's data about talk of non-existent objects. These two issues can be illustrated respectively as follows:

Problem 1. Consider the following triad of sentences:

(F1) The morning star is the evening star.
(F2) John believes that the morning star is bright.
(F3) It is not the case that John believes that the evening star is bright.

Intuitively, this triad could be empirically true, and yet it appears to be inconsistent if the 'is' occurring in (F1), (F2), and (F3) is interpreted as identity obeying Leibniz's substitutivity law.

Problem 2. Consider the following sentence:

(M1) The round square is round.

Meinong pointed out that (M1) can be viewed as analytically true, and yet, as illustrated by Bertrand Russell, it must be false, since no square can be round.

While describing the main features of guise theory, how guise theory deals with these issues will be shown.

Guise theory is characterizable as a *phenomenological ontology* – a description of the most general aspects of the phenomenal world – as opposed to a *metaphysical ontology*, which more ambitiously tries to investigate the noumenal world.

Besides appealing to this Kantian dichotomy, guise theory traces back to Plato, Leibniz, Frege, and Meinong (cf. Castañeda 1974) as proponents of a world-view in which abstract entities are the most fundamental ontological units and have their being independently from particulars, which are somehow derived from them.

Guise theory distinguishes two kinds of primitive simple abstract entities: on the one hand, n-adic properties (relations) and, on the other hand, operators, e.g. connectives and quantifiers, which 'generate' complex entities from simpler ones.

Guises are complex entities whose 'genera-

tion' is characterizable as follows: first, given any number of properties, say $F_1, \ldots, F_n$, the *set forming operator*, $\{ \ldots \}$, generates the set $\{F_1, \ldots, F_n\}$. Second, given any such set, the *concretizer operator*, c, generates the guise $c\{F_1, \ldots, F_n\}$ (Castañeda 1974, p. 10). The set $\{F_1, \ldots, F_n\}$ is designated as the *core* of $c\{F_1, \ldots, F_n\}$. Two guises are to be considered identical if and only if their cores have exactly the same members.

Guise theory proposes its guises as:

1. aspects, facets, indeed *guises of* ordinary objects such as people, cows, tables, chairs, considered, so to speak, in their massive entirety;
2. the concrete individuals somehow present to our mind in our thinking episodes and perceptual experiences, whether veridical or not;
3. the entities which function as (thinkable) *denotata* of singular terms.

Ordinary objects are too 'big' to enter the human mind. Guise theory characterizes this limitation as an inability to contemplate an object with an infinite number of constituents, e.g., an infinite set. In fact, an ordinary physical object is characterized by guise theory as a *consubstantiational cluster* (CC), i.e., an infinite set of guises bearing to each other and to themselves the contingent relation of consubstantiation C^*. Among the laws governing C^* are:

(1) *consistency*: no guise of the form $c\{ \ldots, P, \ldots, -P, \ldots \}$ can be in a CC;
(2) *completeness*: for any property P, and any CC a, there is some member of a that has either P or $-P$ in its core.

For any set of properties, there is a corresponding guise, and all guises have being in the Platonistic sense. Nevertheless, not every guise exists. According to guise theory, to exist is to be *self-consubstantiated*. This is tantamount to saying that all existent guises are members of one consubstantional cluster or another. Since both guises and CCs are sorts of bundles, guise theory can be considered a *bundle-bundle* theory of ordinary objects (Castañeda 1977, p. 322).

It follows from the laws governing C^* that CCs are semi-lattices of consubstantiation at the top of which there is a *Leibnizian individual* (Castañeda 1974, p. 25), i.e., a guise which in some sense can be said to 'mirror' the possible world it belongs to and any other Leibnizian individual in it. Leibnizian individuals have an infinite core having as member, for any property P, either P or $-P$ (but not both).

Given (2) above, and the fact that guises are not simply pointers to, but constituents of, ordinary objects (in the sense in which a set is constituted by its members), it follows that guise theory endorses a realist, non-representationalist view of our epistemic 'commerce' with ordinary objects. In other words, according to guise theory, the latter are *not* Lockean substrates which remain completely external to our mind.

Although the human mind cannot contemplate ordinary objects in their entirety, it can attempt a never-ending piecemeal reconstruction of them. For example, on the basis of empirical observations, backed by assumptions about causal laws, one can arrive to assert (F1) above.

In its default meaning, (F1) is interpreted by guise theory as the assertion that $c\{$celestial body, appearing in the morning$\}$ and $c\{$celestial body, appearing in the evening$\}$ are in the same CC. In other words:

(F1′) $C^*(c\{$celestial body, appearing in the morning$\}, c\{$celestial body, appearing in the evening$\})$.

C^* shares much in common with identity, which justifies calling it a *sameness relation*. For example, it is an equivalence relation and allows for substitutivity in extensional contexts. Nevertheless, C^* is not identity. The former can be true of *distinct* guises, as in (F1′), whereas the latter holds only between an entity and itself and fully obeys Leibniz's substitutivity law.

By reading the 'is' of (F1) as C^*, guise theory provides an original solution to Problem 1 above. Frege solved this problem by means of his *senses* and the distinction of two primitive semantic relations: *expressing* (a sense), and *denoting* (an object, in extensional contexts, a sense, in intensional con-

texts). Although guises can be seen in a number of respects as the counterparts of Fregean senses, guise theory solves Frege's paradox with only one semantic relation: *denoting* (a guise, *both* in intensional *and* extensional contexts) (Castañeda 1974, p. 30).

In general, a definite description of the form *the* F_1, ..., F_n denotes the guise $c\{F_1, ..., F_n\}$, where the concretizer c corresponds to the definite article 'the'. A proper name denotes a guise 'indirectly' in the sense that it is a restricted free variable ranging over guises (Castañeda 1974, p. 27). A demonstrative or indexical expression, in virtue of its generic meaning and of being 'anchored' to a given experiential content, denotes an indexical or demonstrative guise (Castañeda 1977, p. 320) internal to the experiential content.

For example, 'this' in its typical use denotes a guise having in its core the property of being in a certain position in a given perceptual field, as well as a number of, e.g., visual, auditory, tactual properties, depending on the kind of perception in question.

In another example, the pronoun 'I', as standardly used in a given thinking experience, denotes an indexical *I-guise* (cf. Tomberlin 1983, p. 325) whose core contains the purely subjective property relating to the peculiar self-awareness of the thinking subject in that particular thinking experience. These inherently perspectival, subjective features of indexical guises are at the root of the phenomenon of quasi-indexical reference (cf. Tomberlin 1983), by means of which one gets as close as possible to denoting the indexical guises thought of or perceived by other minds, without, however, fully succeeding in this.

According to guise theory, consubstantiation and identity provide but two of the senses of 'is (the same as)'. Guise theory distinguishes at least these other sameness relations (cf. Castañeda 1974):

1. *Conflation*, $^*C$, which holds between two guises just in case they have logically equivalent cores. Two conflated guises may not be consubstantiated, but the laws governing C^* and $^*C$ require that any existent guise is consubstantiated with any guise it is conflated with.
2. *Consociation*, C^{**}, which holds between two guises that are thought of as consubstantiated by a mind, e.g., in the creation of fiction or in entertaining a belief. C^{**} is contingent like consubstantiation, but because of the limitations of the human mind, laws such as consistency and completeness do not hold for *consociational* clusters.
3. *Transsubstantiation*, the relation which links guises across time or across worlds.
4. *Transconsociation*, the relation which links guises across different pieces of fiction.

According to guise theory, there are two fundamental senses in which one can predicate a property of a guise:

1. A property P can be truly predicated of a guise g, in the *internal* sense, just in case P is in the core of g;
2. a property P can be truly predicated of a guise g, in the *external* sense, just in case there is a sameness relation S, and a guise g', having P in its core, such that $S(g,g')$.

The distinction between internal and external predication is used by guise theory, *inter alia*, to cope with Problem 2 above: guise theory considers (M1) true from the point of view of internal predication (thereby accommodating the Meinongian intuition), and false from the point of view of external predication (thereby accommodating the Russellian intuition as well).

Besides Problems 1 and 2, the guise-theoretical machinery of guises, sameness relations, and internal predication accounts in a unitary way for a vast collection of data that ground and motivate the theory. This collection includes:

1. thoughts and talk about non-existents, whether in fiction or in real life situations, e.g., in planning;
2. the aforementioned Frege paradox and similar puzzles having to do with referentially opaque contexts;

3. P. T. Geach's puzzle of intentional identity, and related issues;
4. issues of identity across different frames of reference, such as time intervals, possible worlds, stories;
5. rigid vs. non-rigid uses of definite descriptions;
6. data related to the use of demonstratives, indicators, and quasi-indicators.

Many issues related to 1.–6. above go beyond what guise theory was originally designed to address and this shows the fruitfulness of the theory. This fruitfulness is confirmed by the fact that guise theory has inspired work (by William Rapaport) in the reconstruction of Meinong's thought and in artificial intelligence.

A number of interesting critical papers on guise theory, together with Castañeda's replies and extended bibliographies, are in Tomberlin 1983, 1986.

See also: **Meinong, Alexius I: Meinongian Semantics**

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FRANCESCO ORILIA

Gurwitsch, Aron

Aron Gurwitsch (1901–73) was born in Vilna, Lithuania, into a family noted for rabbinical scholarship. Between 1919 and 1923 he studied under Carl Stumpf (1848–1936), Edmund Husserl (1859–1938), Adhemar Gelb (1887–1936), and Kurt Goldstein (1878–1965). His dissertation *Phänomenologie der Thematik und des reinen Ich* was published in *Psychologische Forschung* in 1929. Gurwitsch fled National Socialism in 1933, teaching thereafter in Paris and in the United States.

Gurwitsch developed the ontology of consciousness as a revision and elaboration of Husserl's general theory of intentionality as set forth in *Ideas* I of 1913. He accepted Husserl's distinction between the event, sense, and referent of a mental act of attention, and accepted Husserl's transcendental idealism as the project of *accounting for objects* by describing the acts, senses, and laws of thematic transformation via which they become manifest to consciousness.

Gurwitsch departed in various details from Husserl. He rejected Husserl's egological account of attention in terms of the act of a *'transcendental ego'*, preferring instead descriptions of *thematic transformations as operations mapping from themes to themes*. He rejected Husserl's account of intentionality as an act bestowing meaning on sense data, and rejected Husserl's account of the relation of the object which is intended to the *Sinne* via which it is intended. Finally (under the influence of Max Weber and Alfred Schütz), he rejected Husserl's account of the relation of the world of purely bodily nature (*die Dingwelt*) to the cultural life-world.

These departures from Husserl derive from Gurwitsch's Gestalt-theoretic revision of the Stumpf–Husserl doctrine of dependent and independent parts. Gurwitsch defined any part of a theme of attention as *independent* if it is thematizable via the transformation of singling out, and as *dependent* otherwise (1966, p. 264). Gurwitsch described his denial "that an item which is susceptible of being singled out remains phenomenally the same when it is singled out" as the crux of his departure from Stumpf and Husserl, "who maintain that an item can merely be isolated and otherwise remain what it is" (1966, p. 264 ff.).

Gurwitsch's definition of dependent and independent parts in terms of processes of consciousness whereby they become themes of attention is in striking contrast to the definition in terms of *foundation* suggested by Husserl in the third *Logical Investigation*, and lends a characteristic flavour to his work as a whole.

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GILBERT T. NULL

H

Hartmann, Nicolai

Nicolai Hartmann (born 1882, Riga; died 1950, Göttingen), disciple of Hermann Cohen (1842–1918) and Paul Natorp (1854–1924), the leading scholars of Marburg neo-Kantianism, was appointed in 1922 to the chair of philosophy in Marburg, succeeding Natorp. In 1925 he was appointed to the chair in Cologne, in 1933 to the chair in Berlin, and in 1945 to the chair in Göttingen. Influenced by the phenomenology of Edmund Husserl (1859–1938) and Max Scheler (1874–1928), Hartmann turned away from neo-Kantianism and initiated a 'new ontology' from 1919 onward. After the publication of his first systematic work, *Grundzüge einer Metaphysik der Erkenntnis* (1921), he soon became one of the leading thinkers of 20th-century German philosophy.

Hartmann's epistemology goes beyond the restriction to the subject of knowledge and to the objects as 'constituted' by the subject and reaches out once more to 'the being *qua* being' which is independent of all knowledge. On this basis Hartmann develops his ontology in four extensive volumes: *Zur Grundlegung der Ontologie* (1935), *Möglichkeit und Wirklichkeit* (1938), *Der Aufbau der realen Welt. Grundriss der allgemeinen Kategorienlehre* (1940), and *Philosophie der Natur. Abriss der speziellen Kategorienlehre* (1950). His procedure is strictly directed towards the transubjective reality and he analyses in detail the *categories* thereof. Hartmann thereby distances himself from that other great 'new ontology' of our time, the existential ontology of Martin Heidegger.

Hartmann embraces a stratified hierarchical system of the world (*Schichtenlehre*). He defines the categorical characteristics of the four 'strata of being' (anorganic, organic, psychic or '*seelisch*', mental or '*geistig*') and the laws of their interdependence. Hartmann lays stress on the distinction between '*seelischem Sein*', studied by psychology, and '*geistigem Sein*', appearing e.g. in language, humanities and sciences, law and ethics.

Generally, his method comprises three phases:

1. phenomenological description;
2. analysis of the problems that thereby become apparent; and
3. solution or, if this is not possible, limitation of these problems.

By refuting neo-Kantian logical idealism, Hartmann not only creates a new ontology centred on being *qua* being, he also turns back to metaphysics, even though it is a metaphysics of problems only, i.e. limited to the mere analysis of those unavoidable though unsolvable questions which finally emerge for human reason in all fields of research. Remarkably enough, he practically excludes the question of the philosophical knowledge of God, even though he claims that reason must not avoid any of the problems which it is confronted with.

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JOSEF STALLMACH

Hayek, Friedrich A. von

Friedrich August von Hayek was born in Vienna in 1899. He studied law, and economics with Friedrich von Wieser (1851–1926), and subsequently worked with, and was influenced by, Ludwig von Mises (1881–1973). He was appointed to a chair in economics at the London School of Economics in 1931, and moved to Chicago in 1950. He subsequently taught in Freiburg im Breisgau from 1962 to 1967.

Hayek is well known for his work on economics in the tradition of the Austrian School of marginalist economics, founded by Carl Menger (1840–1921). He was awarded a Nobel Prize in 1974. He has also written extensively on political and legal philosophy and on the methodology of social science, as well as on the character of human sensory experience. There are interrelations between his work in these different areas.

In economics, in addition to work on the theory of capital and on trade cycles, Hayek extended Ludwig von Mises's ideas about the problems of economic calculation under socialism (*Individualism and Economic Order*, 1948). Hayek pictured markets as enabling individuals who do not have face-to-face relations to co-operate, and to make use of dispersed and tacit knowledge of a character that could not be made available to a central planner. He also stressed the way in which, within markets, individuals and companies can learn by trial and error, and developed a view of competition in markets as a discovery procedure (*New Studies*, 1978).

Like many economists, Hayek has been concerned with the systematic consequences of self-interested human action; but his work is marked by a distinctive concern for human action and perception as subject to rules and kinds of ordering of which we are not ordinarily aware (*Studies in Philosophy, Politics and Economics*, 1967; *New Studies*, 1978).

Hayek has been interested in the relation between such rules and orderings and the large-scale consequences to which they give rise. In this connection he has discussed not only markets, but also other social institutions such as law and language. He has also been much concerned with the idea of 'spontaneous order': with institutions that are neither innate to man nor deliberately designed, but are the unintended products of human action, and seen as the products of a form of cultural evolution (*Law, Legislation and Liberty*, 1973–8; *The Fatal Conceit*, 1988).

In discussing social institutions, Hayek generalizes ideas drawn originally from his understanding of the market, contrasting a *nomos* or spontaneous order with a *taxis* or order in which the movements of each element are fully planned. Hayek also allows that we can design institutions to work on the model of a spontaneous order. This idea is illustrated by his own constitutional proposals, and by his proposal for the 'denationalization of money'. While in his more recent writings Hayek has offered an 'evolutionary' account of the development of social institutions, he has stressed that we can, and should, make piecemeal critical improvements to them and has in this connection drawn parallels with Karl Popper's 'critical rationalism'.

Hayek has also written extensively on the methodology of social science, where he has emphasized that human action is performed in relation to objects as they are classified and understood by the agents involved (as opposed, say, to the way in which a physicist might understand them). (See *The Counter-Revolution of Science*, 1952.) In his work on perception (notably *The Sensory Order*, 1952), he has argued that objects as we perceive them have qualities which are the product of contrasts and differentiations that have been made by us unconsciously. In his view, these contrasts and differentiations also play an important role in constituting our

sensory and cognitive apparatus. Hayek pictures our own reason as a product of cultural evolution, and has argued that the ordering of our experience has aspects of which we cannot become fully aware.

Hayek has also argued that there are limitations on our ability to predict the behaviour of complex phenomena, including both spontaneous social orders and such natural phenomena as the tides. While we cannot hope to make detailed predictions of their behaviour, we can arrive at 'explanations of the principle', which enable us to make 'pattern predictions' about them (*Studies in Philosophy, Politics and Economics*). Hayek has also criticized the 'scientism' of those who advocate, in the social sciences, ideas about method or explanation drawn uncritically from the natural sciences, or from what they take the natural sciences to be. Hayek's work on these themes is offered as a contribution to methodology and the theory of explanation. Yet there is a connection with larger themes in Hayek's work. For Hayek is concerned that knowledge of the characteristics of markets, and of other complex phenomena, will be overlooked, and useful institutions damaged, if scholars use inappropriate criteria to appraise our knowledge in these areas.

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JEREMY SHEARMUR

Hegel, Georg Wilhelm Friedrich

If someone had asked J. G. Fichte (1762–1814), F. W. J. Schelling (1775–1854), or G. W. F. Hegel (1770–1831) whether they had written a metaphysics, they would have flatly denied it. For them 'metaphysics' designated a pre-Kantian effort that, moreover, relied on Leibniz's principle of identity, which they considered a characteristic of a static type of thinking.

Nevertheless it is obvious that at least some parts of their philosophies were a continuation of the endeavour first conceived of by Aristotle. This is particularly true of Hegel. Strangely enough, perhaps with the exception of N. Hartmann, this was hardly noted by German scholars who were under the sway of historicism; the continuity between classical metaphysics and Hegel's philosophy was noticed mostly by British authors such as J. M. E. McTaggart and W. T. Stace. The latter's ahistorical approach to Hegel through Aristotle was probably due to didactic motives: at the end of the 19th and the beginning of the 20th centuries the philosopher whom British scholars and students knew best was Aristotle. The following remarks do not, however, rely on the comments of these authors.

For Aristotle, being was in the primary sense of the term substance (οὐσία); to him the real was a sum of individuals related to each other in many different ways. Therefore, the central problem of his metaphysics was the question of how to define οὐσία: it was something in all respects individual, to which universals could nevertheless be truly attributed. One of Aristotle's concerns was to show that his universals were more than Platonic ideas projected into the substratum of matter; for, on the one hand, what Plato had called ideas did not exist, except in man's (and since Augustine, God's) mind, and, on the other hand, Aristotle held that there existed immaterial substances.

Neoplatonism and, later, Aquinas added an important insight which Aristotle had not dwelled upon: though all first substances do actually exist, they are not equally 'present to themselves'. This 'presence of a being to itself', most clearly embodied in knowledge, they understood as a being's ability to retain for itself the 'products' of its acts. Mere bodies could only act on other bodies; animals (and to a lesser degree plants) had an immanent activity called 'life' and they could feel; beings endowed with an intellect reflected within themselves the world around them and indeed the order of being; God, for

them, was a being whose very nature was an unlimited actuality of self-presence.

In a way, Hegel continues to think along the same lines. Between classical metaphysics and Hegel, however, there were Spinoza and Kant. For Hegel, to be amounts to being present to oneself; in fact, Hegel describes the difference between potentiality and act as the difference between what merely is and what has a hold upon itself. As an heir to Kant, Hegel could not start with individuals in the way Aristotle had done.

If individuals existed at all, they were limit concepts only; everything had to be explained by something issuing from a mind in which everything is 'universal'. Accordingly, the real could not be a sum of individuals related to each other in different ways; it had to be a Mind generating individuals as its limit concepts.

Of course, Hegel knew that our experience informs us only about minds that belong to, and thus presuppose, natural beings; mind, he said, presupposed nature. Therefore nature had to be described as something through which a cosmic intelligibility becomes aware of itself. Logic articulated the patterns of a Mind that expresses itself in the kind of reality studied by the Philosophy of Nature; and the history of the minds in nature was the process through which the intelligibility of the real became present to itself. Without nature, the basic pattern of Mind would be a mere possibility, a dynamic structure; without the history of the minds in nature the latent Mind would never become truly itself. In the end, something like Hegel's own philosophy, which is the completed self-presence of the history of the minds in nature, is *the* Mind. Preposterous as it may sound, Hegel's teaching is the whole of reality thoroughly present to itself. Therefore, after having described his philosophy as 'Absolute Knowledge' itself, Hegel concludes his *Encyclopaedia* with a quotation from the twelfth book of the *Metaphysics* in which Aristotle describes God as the νόησις νοήσεως, the knowledge of knowledge.

This grandiose and perverse project has numerous consequences. Above all, relations cannot be something superadded to substance as individuals are not primary, they are a synthesis of relations (for universals *are* relations). Therefore all relations are of the kind which later scholastics such as John Duns Scotus called 'transcendental' and F. H. Bradley (as well as his critic G. E. Moore) dubbed 'internal'. What seems to be an individual in reality is nothing but a being-related to something else and, in the end, to everything. The only subsistent reality is 'the whole', which may be grasped only by thinking about, and in the end reflecting upon, all of its dimensions. As a further consequence, each and every separate statement is false or at least one-sided; only the ultimate philosophy as a whole is genuinely true. This ultimate philosophy is the self-understanding of the history of the universe, including everything this history presupposes. In fact, Hegel's pupils began to wonder how real history, not to speak of the history of the mind, was to continue.

There is even a sense in which Hegel understands being just as Aristotle did. It is the most abstract of all concepts; but as nothing can be added to it, it is also the most concrete, in fact only reality. Therefore, Hegel argues, it is self-contradictory, which is why, thinking about it, we have to move to its opposite, nothingness. But nothingness is not; thus we return to being, which now ha to be understood as a unity of being an non-being, that is, becoming. But a becoming is always a becoming of something that is; thus we again reach a new notion. As this process goes on, the most abstract universal moves as if by itself, becoming more and more concrete; in the end it has become so concretized that it 'turns' into the reality of nature which Hegel discusses in a similar vein. But nature, being real, is a presence-unto-itself; therefore life and mind and culture develop and in each of them reality becomes more present to itself. In the end, there emerge art, religion, and philosophy and the latter develops into a total comprehension of everything, including its own history. God, who at the beginning was nothing but an intelligibility presupposed by the real, has reached his ultimate completion, and he has reached it by an unfolding, in part 'logical', in part historical, of

what the notion of being contains. Aristotle and Thomas Aquinas, too, spoke of an unfolding of being; but they never understood it as a 'real process'. For to them, being was ultimately a concept generated by the human mind.

It has been rightly remarked that Hegel writes his philosophy from the point of view of the Absolute, i.e. of God: Logic describes how his own nature unfolds, the Philosophy of Nature tells how God creates the world, the Philosophy of Mind how God returns unto himself. One is almost reminded of the tripartition of Aquinas's *Summa*: God, the creatures, Ethics as the creatures return to God. Yet Hegel's God is not a pure actuality present to itself; he is the becoming of such an actuality and it is he himself, not his creature, who returns to himself. Between classical metaphysics and Hegel stand not only Spinoza and Kant, but also gnostic, cabbalistic, and theosophical speculations which suggest that created entities are a development of God himself. In Hegel, God literally needs the world in order even to be God; without it, he would only be a conceptual framework in the mind of no one. This in turn means that if, as no one would want to deny, there is anything at all, then God cannot but culminate in an ultimate philosophy. As in Aristotle, he is a νόησις νοήσεως; but the latter is a human endeavour, namely, philosophy.

The path to the Absolute's standpoint is mapped out in the *Phenomenology of Mind*. One of the many weaknesses of Hegel's philosophy is that he never succeeded in incorporating this ascent into his system. The Absolute is the universe comprehending itself; but man's way to the starting-point of its comprehension belongs neither to the universe nor to the Absolute. Hegel tried to disguise this fact by intimating that the history of philosophy from Parmenides to himself was just such an ascent; but as this ascent has to be repeated by everyone trying to think as Hegel did, ordinary life and its experience remain 'unexplained'. These are the lowlands of the Aristotelian individuals related to each other only by ordinary relations in the Aristotelian sense, both of which Hegel held in disdain.

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NICHOLAS LOBKOWICZ

Heidegger, Martin

Martin Heidegger was born in Messkirch/Baden in 1889 and died in Freiburg in 1976. His enquiry into being-as-such began in 1907 when, as a secondary school pupil he read Franz Brentano's *On the Several Senses of Being in Aristotle*, published in 1866. Heidegger obtained his Ph.D. in 1913 and his habilitation in 1916 at the University of Freiburg im Breisgau. He served for a time as Edmund Husserl's assistant, and concluded his probationary period in phenomenology in 1927 as professor in Marburg with his main treatise *Being and Time*, a book that immediately gave rise to much discussion.

Phenomenology, according to Heidegger, had up to then constituted nothing other than "a primarily methodological approach and conception". Heidegger seeks to make the Husserlian conception more concrete, starting out from the phenomenologist's transcendental analysis of the intentionality of consciousness and breaking through to what he calls an existential analysis of being-in-the-world. *Dasein* or being-there for Heidegger, i.e. the human individual in his full integrity as a living being, has priority over mere consciousness. Heidegger accordingly analyses expressly that realm which Husserl had

singled out under the heading "world of life experience", and which he later, under the influence of Heidegger's *Being and Time*, rechristened the life-world or *Lebenswelt*. Heidegger leads ontology back to its core, in man, in the human individual as a whole.

In the years between 1928 and 1945 Heidegger served as Husserl's successor in Freiburg. He twice declined a call to Berlin. In 1933–4 he served as rector, but resigned before his term was up. Later writings and lectures unveil a certain ambivalence *vis-à-vis* all political affairs, even towards human existence in general, an attitude suited to the insights of his ontology and to his rethinking of being-in-itself wherein he sees himself as having exposed a certain existential tension, tautness, or torn-apartness in the human individual, a conflict setting the behaviour of the human individual against his fellow beings, against the world, the universe, the cosmos.

Suspended from his professorship in 1945, he opted in 1952 not to accept an offer to return to his former chair. From time to time he held lectures and seminars, especially in France and Switzerland.

From Ontology to Fundamental-Ontology. Heidegger asks: what is being? What is the meaning of being-in-general? – this being that is always, everywhere implicitly or explicitly presupposed in our thinking and speaking, explicitly in most of the Indo-European languages. This comes across particularly in ancient Greek, where from 700 BC the forms 'am, is, be, was, were, being' held philosophers in suspense. "Being is said and interpreted in many ways", is how Aristotle worded the problem of ontology, and this Heidegger considers the guiding principle for his own interrogations. Philosophy was and is ontology; it interprets being by unfolding, disentangling, analysing it: first and second substance (Aristotle), beings and their essences or natures, reality and actuality, possibility and potentiality, these are ontology's fundamental concepts. They comprehend everything, all things as things that *are* and that simultaneously stand in relation to the whole of all that is. A tree, a house, a human individual, God – all are. There is one sole being in which essence and existence, possibility and reality, coincide: the perfect, consummate being, God. After the fashion of this unique coincidence of essence and existence devised in ancient and medieval ontology, Heidegger conceives an analogous coincidence in man. The essence (nature) of *Dasein*, i.e. of the human individual, lies in his existence. This is Heidegger's initial postulate. The human individual is the fundamental notion of his fundamental-ontology. The latter has to perform the function of interpreting being-as-such, i.e. via man as *Dasein*.

From the Question: What is Being-as-Such? to the Question: What is Time? *Dasein* is the human being, which is to say that existent for which 'being' is or is present, and to which being opens itself. Being, which was traditionally understood as eternal and true being, becomes temporal, enters into time, according to Heidegger, in man. The questions of time and truth are thus addressed in the question of man, and all of these questions are addressed together in *Being and Time*, Heidegger's *magnum opus*, where he presents the being of man and at the same time presents being to man.

Man is the ontological animal. He articulates being, however, not only in his thinking and knowing, but also in the practical side of his life. It is in existing, and thus in his feelings, moods, and also in all forms of speaking and understanding, and not in *theories* that being expresses itself. Being is lived, not observed. Thus man experiences being in the entire span or tension between reality and possibility. These coincide and yet at the same time they tear man apart.

The main thesis of the older ontology is this: that God, the perfect, consummate being has annulled tension and torn-apartness. According to Heidegger, man never neutralizes this tautness. He carries it through to the full term, bears the tension until death. Thus, possibility is simultaneously reality, and reality is potentiality. More problematically expressed: existing for the human individual means on the one hand reality; on the other hand, however, and more importantly, it means possibility.

Man is not. He has to be. This is man's task. The first division of *Being and Time*,

entitled "Fundamental analysis", makes this thesis more concrete. The essence of *Dasein* is his existing, and in this is announced his task, the obligation or condemnedness to be. Fundamental-ontology leads to specific categories which Heidegger singles out by calling them 'existentials', as contrasted with the traditional categories of the older ontology. While the latter had easily lent themselves to be expressed in substantival forms (which shows that they were more or less determined by the idea of substance), Heidegger has the alternative of formulating his existentials not so much by means of nouns as by means of verbs, adverbs, even prepositions. Certainly he, too, sometimes employs the traditional substantialistic style and employs nouns to describe his new existentials. In the last analysis, however, it becomes clear that the experience of existence and of being-as-such can be formulated only by indirect linguistic hints and indications. A substantivizing approach would be tantamount to substantializing or hypostasizing a constellation of actualities which allow themselves to be stated neither in categories of being nor in categories of consciousness, but only, Heidegger claims, through existentials. The analysis begins with the existentials of being-there as "being-in-the-world", of thrownness, forlornness, forsakenness, of the "project" or life-task. It ends with the existential of concernedness or preoccupiedness with or caring-for.

The second section of *Being and Time* concerns the correlation between being-there and temporality or time-like-ness. The two hang together in that a possible wholeness of being-there and a being-towards-death coincide. Experiencing being-in-itself turns into the experience of time as 'truth' and as 'horizon' of being. Likewise the existential analysis of being-there leads from being-as-such to time. Heidegger's second section ends in an analysis of 'temporality and historicity', that is in an investigation of time in general and of our understanding of time. Being-as-such turns out to be thoroughly suffused or marked by time and by the experience of time. Being-there and existence are ineluctably an experience of historicity. There is no being-in-itself outside and without time. Heidegger's investigations of being-in-itself hereby temporarily fade into the question: what is time or what does 'time' mean? Being-as-such and time once again mirror one another.

The planned third section was destined to be called *Time and Being*. This, however, was never published. Throughout his life, Heidegger continues nevertheless to be obsessed by the 'turnabout': it remains his central task. In 1969, thematizing this reversal explicitly in his treatise *Time and Being*, he expounds the reasoning that had led to the appearance of *Being and Time* and emphasizes the temporal character of being-in-itself and its historicity. He there calls being-in-itself destiny, fate, or doom. Finally he calls it the 'event' or *Ereignis*, the happening, a word used after 1936 and especially in the so-called 'second main treatise', *Contributions to Philosophy* (*Of the Event*), a work published posthumously in 1989 in a version in all likelihood edited by Heidegger himself. This book remains still but a torso, a fragment, and for good reasons: Heidegger did not want to have it published while he was still alive. In it, he wrestles for an experience of the being-as-such in its quality as the event, the happening in general, to which all beings – and more than anything else all human individuals – are consecrated, dedicated, doomed.

An Insight Into That Which Is. Heidegger seeks an insight into that which is, especially in a course of lectures discussing tool-making crafts as an anthropological phenomenon – or, in other words, technology. In this course, under the title: "Technics and turnabout (from being and time to time and being)", he calls tool-making and technology the *Gestell*: the scaffolding, arrangement, the bringing to a stand or immobilizing of a being. Technology aims at *Herstellung* or creation, at the manufacture of instruments or utensils, at the making of machines designed *ex nihilo*. From the beginning of the modern era, which is to say from Thomas Hobbes to Karl Marx, this thoroughly artificial, man-made, invented bringing forth is seen as a creation of self and thereby also of a world, a world augmented, aggrandized from the merely biological. From this point of view man is considered as

the subject who presents and creates: this subject sets or projects inventions or designs before his mind's eye; on the one hand he visualizes, ideates, imagines, and on the other hand he makes, creates, brings forth, puts his imaginations into practice. Man is supposed to understand only that which he makes from nothing; he is supposed to understand off his own bat exclusively the mechanisms of his own artefacts.

Vorstellen, ideating, visualizing, imagining, inventing, *Herstellen*, making, the artificial, the man-made – all of this is what Heidegger tries to explain in its radicalness by naming it the *Gestell*: the scaffolding, mounting, organizing, bringing to a stand. Regarding technologies, the point is not only to describe the fact that the human being creates artificial instruments and that he considers himself as their creator. One has to describe also the fact that man is prisoner both of his *Vorstellen* (ideating, visualizing, inventing), as also of his *Herstellen* (creating, making, constructing). He is thereby *umstellt* (encircled, surrounded) by his own man-made gigantic superhuman *Gestell*: the scaffolding of his technology. He is, in his existence, put to a stand or driven to the wall by his machinations and machineries, by himself as a sorcerer's apprentice. His existence is blinded and obstructed; it is barred and blocked up by the man-made realm, the artificial paradise of his gadgets. World and nature are in this way themselves set at bay, or set in order; they are organized or structured and thereby *verstellt* (blocked up, blinded, barricaded). Nature reaches the point where it is turned upside-down by the scaffolding of technology and is thereby disfigured beyond recognition.

Heidegger wants to grasp and characterize a very intricate, and enormous, constellation of man-made facts and realities. It becomes thereby evident how much thinking is linked to speaking and depends on the idiomatic idiosyncrasies of a single language – in our case, on German and indeed on Germanisms (on the Germanisms of the German idiom). Philosophizing, or speaking philosophically, is conceptualizing an experience, stating a constellation of facts and circumstances. But that is always, again and again, the question; and Heidegger – who intends to speak about being-in-general and about human being by characterizing them by using words such as 'event', 'happening', 'doom, fate, destiny', 'scaffolding' – is fully aware of it.

The History of Ontology. In the rough sketch and first project, *Being and Time* was supposed to comprise two halves, and not only the three divisions of the first half. The non-existent second tome ought to have concerned the issue whether and to what extent philosophies, metaphysics, and ontologies have as yet asked the question of the meaning of being, which is to say the question: what does being mean, the question as to being-as-such and in itself and in general? Or has philosophy dodged this issue? Heidegger accuses philosophy hitherto of forgetting being-in-itself, of dooming being to oblivion. The second volume has never been published; but Heidegger did not cease to investigate exhaustively, in his subsequent lectures and various later writings, the history and the sins of omission of the older ontologies in the light of the question of being. His investigations are well documented in the "Complete edition" from 1975 onwards. In it, many courses of lectures are surprisingly easy to read and to understand. In the so-called late writings, however, dating back to the appearance of *Being and Time* and treating of the turnabout from *Being and Time* to *Time and Being*, Heidegger is searching for a new language, and the wording of his ideas becomes ever more metaphorical.

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Heraclitus

Heraclitus of Ephesus, an Ionian Greek colony on the west coast of Asia Minor, probably lived from about 540 to about 480 BC. He was said to be of aristocratic, even royal descent, and he was credited with a single book, later entitled *On Nature*, which was famous throughout antiquity for the obscurity of its language. Ancient writers have preserved for us only a somewhat random series of brief sayings of Heraclitus, and, although these number well over 100, there has been controversy as to whether the book itself was a mere collection of sayings or presented a continuous and perhaps rather more systematic account of his views. Doubts as to whether there was any such book at all seem to be answered, however, by a quotation specifically assigned to the beginning of the book by Sextus Empiricus (*c.* 150–*c.* 225), *Adv. Math. VII* 132.

It is clear that Heraclitus believed that he had arrived at a special insight into the nature of truth and reality, and his views had an immediate impact on those who came after him, an impact not exhausted even at the present day. The attempt to reconstruct his thought from the surviving fragments alone is difficult and unsatisfactory, yet their discussion in the context of the writings in which they occur is also dangerous as introducing distortions. Often, however, it is just the way in which his ideas were taken up by later thinkers which gives them their historical importance. This difficulty provides us at the outset with a kind of tension in interpretation which is itself Heraclitean in its operation.

Central to his thinking is his use of the term *Logos*, combining three strands of meaning: what people say, what Heraclitus himself says, and a kind of universal formula found at the base of all cosmic processes including human experience. The Stoics equated this concept both with Reason and with God as the Active Principle which controls the structure and activity of the universe. For Heraclitus its most important manifestation was in the provision of an underlying connection between opposites. He accepted from some of his predecessors the doctrine of an unceasing conflict both of physical opposites such as Hot and Cold (regarded as separate substances) and of other purely qualitative opposites such as harmful and beneficial. But he added a doctrine of the unity or identity of opposites according to which one thing is all things and all things are one thing, being both divisible and indivisible, generated and ungenerated, mortal and immortal and so on (Fragment 50). This identity was associated, however, with a belief in perpetual change and strife between opposites. So even Justice is Strife – all things are fitted together in a kind of two-directional tension as in a strung bow and a lyre (Fragment 51).

This doctrine of perpetual change appealed strongly to Plato as explaining the phenomenal world in contrast to the unchanging Platonic Forms. It is Plato who gave currency to the supposedly Heraclitean doctrine of Universal Flux expressed vividly in the statement that it is not possible to step twice into the same river because it will have changed in the meantime, to which a later Heraclitean, Cratylus, added 'no, nor even once either' because it is changing even as you step into it. For Heraclitus the world order itself is eternal and this could be expressed by regarding ever-changing Fire as the ever-living source of all things. Later writers fitted Heraclitus into their schematized accounts of the pre-Socratics by supposing that for Heraclitus Fire was the primary substance, as water was for Thales of Miletus (fl. *c.* 580 BC). But for Heraclitus it was probably a concrete manifestation of the *Logos* "kindling in measures and being extinguished in measures" (Fragment 30).

This and similar statements led the Stoics to attribute to Heraclitus a doctrine of a world cycle leading to a periodic Universal Conflagration when everything returns to the original fire, followed by a rebirth of the world exactly as it was before. God is identified by Heraclitus with the opposites, as that which persists throughout their changes, and

as the knower of all things. The human soul in its proper state is made of fire – sleep, drunkenness, and foolishness generally are due to the moistening of the soul which is subject to the same cycles of change that apply to the rest of the world. Finally, language if properly used must reflect the structure of reality, the linguistic flux corresponding to the flux of experience, a point of continuing interest for those who are concerned with present-day theories of meaning.

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Herbart, Johann Friedrich

Johann Friedrich Herbart was born in Oldenburg in 1776 and died in Göttingen in 1841. He was a leading German educator and philosopher and is now known as one of the founders of modern scientific pedagogy. He exerted a profound influence on teaching practices from the second half of the 19th century until World War I, when the rigid systems into which some of Herbart's followers had transformed his educational ideas were overcome with the appearance of reformist movements. The basic concept of Herbart's pedagogy is that of *Bildsamkeit* (formability), a concept situated between freedom and determinism.

As a philosopher Herbart was important because, as a thinker who had studied under Johann Gottlieb Fichte and who had been appointed to the chair of philosophy in Königsberg formerly occupied by Kant, he reacted successfully against idealism and led to a renewed 19th-century interest in the doctrines of realism. His major philosophical works are *Psychologie als Wissenschaft, neugegründet auf Erfahrung, Metaphysik und Mathematik* (1824–5), and *Allgemeine Metaphysik nebst den Anfängen der philosophischen Naturlehre* (1828–9).

For Herbart philosophy consists of logic, metaphysics, and aesthetics (in which ethics is included). The task of philosophy is *die Bearbeitung der Begriffe* (the treatment of notions): logic clarifies notions and their combinations, metaphysics 'supplements' them wherever logical treatment does not yield a clarification, and aesthetics has to consider that class of notions which imply judgements of value.

The most important metaphysical 'supplement' and basic concept of Herbart's philosophy is that of *das Reale* (the real), which refers to an elementary entity of unknown qualities (cf. Träger 1982). Every phenomenon is metaphysically constituted by a multiplicity of such 'real' components in a kind of atomistic world which can be compared in this respect to that of Leibniz. (A comparison of Leibniz and Herbart was published by Robert Zimmermann in 1849.)

Herbart's psychology consists partly of metaphysics (namely, his account of the ego as a 'real') and partly of a theory of associations in which he aims to explain the movements of *Vorstellungen* (ideas) by different *Assoziationsgesetze* (laws of association). His exact mathematical approach in quantifying these processes has not endured. Many concepts from his psychology of association did, however, exert a lasting influence on Sigmund Freud (1856–1939).

The great importance of Herbart during the last century, especially his profound influence as a psychologist, as promoter of a renewed realism and as a representative of a strict formalistic aesthetics, is completely underestimated today.

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Hertz, Heinrich. See: Semantic Conventionalism

Hierarchy

A hierarchy is a type of order based on relations of priority (anteriority) and posteriority. A clarification of this definition requires a specification of the principle that constitutes order as such.

Order Based on an Immanent Principle. There is an order, for example, between soul and body. Since the soul and the body form one living substantial being, the order obtaining between them is that of an immanent organization. A living being is an organism, and its body is animated and determined in its order by the soul which animates it. When the living being dies, i.e. ceases to be animated, it becomes disorganized, and decomposes. The unity of a living being is thus a typical case of an order of which the specific principle is an immanent form; Western tradition has always called this principle a soul. Of course, this description is acceptable only to those philosophies which recognize the substantial unity of soul and body (e.g. Aristotelianism and Maine de Biran), not to those which distinguish soul and body as two separate substances (e.g. the Scotist tradition and René Descartes). But it is compatible with any attempt to explain the unity of a living being via physiological laws.

Hierarchical Order Based on Efficient Causality. For there to be a hierarchy in a stricter sense, however, there must be an ordering principle exterior to – if not separate from – the reality that is ordered. Now the exterior, if not separate, principles of any reality are its productive agent, its exemplary model and its end. Thus, a series of acting agents can be ordered hierarchically according to the degree of their participation in the causal efficiency of a primary agent. In medieval philosophy, it was usual to distinguish the divine primary agent from created secondary agents, the causal efficiency of the former being communicated to the latter. And there was an important controversy as to whether the communication of divine causal efficiency to the created causes meant that these should nevertheless be regarded as acting autonomously, or whether it meant that they were merely subordinate instruments of God's action. Fearing the second alternative, late medieval followers of Duns Scotus conceived the human will as being capable of acting by itself in order to attain salvation without any *motio praeveniens* of divine grace (Pelagianism). This doctrine prompted the violent reaction of the Reformation. But Thomistic Aristotelianism continued to defend a conception of human will as being free under this *motio praeveniens* of divine grace, a doctrine that is much more satisfactory. Indeed, an instrument is hierarchically subordinate to a principal agent, and lacks any causal efficiency proper to itself, whereas a secondary agent can be subordinate to a principal agent without losing the autonomy of its power of acting. This can be seen even in hierarchical organizations such as armies and political societies, where the subordinate individual acts in virtue of the causal efficiency of his superior; this ensures the unity of action of the organization as a whole without endangering the subordinate's specific autonomy.

Hierarchical Order Based on Exemplarity. In such cases as the above, taken from metaphysical and social contexts, it appears that the secondary agent partakes of the causal efficiency of a primary agent, if not of its authority, and that the subordination of the secondary agent to the primary agent manifests a hierarchy based on exemplarity. In general, a multiplicity of things is ordered hierarchically according to their more or less perfect degrees of participation in one arche-

type. In this proposed definition, the expression 'more or less perfect degrees' taken by itself is enough to indicate a hierarchy. Thus, for instance, there is a hierarchy of beings in relation to their exemplary Idea in Plato's world. In Pseudo-Dionysius, there is a hierarchy of angels and men based on their greater or lesser proximity to God (in this context the term hierarchy has the meaning of 'sacred order'). In more down-to-earth affairs, there is a hierarchy of functions in a political or military organization, which is based on the fact that each member exercises to a greater or lesser extent the causal efficiency communicated by the *princeps*, and thus partakes of his authority, whatever the form of the *princeps* may be. Although the ordering principle, referred to here as an exemplary model, is exterior or separate, this does not prevent it from ensuring the unity of the multiplicity that it orders hierarchically. Strictly speaking, the unity thus secured is relative, it is not absolute like that of a living organism animated by a soul. This relative unity is a unity governed by a principle of measure which determines the *value*, in itself and in relation to its principle, of each member of the hierarchical order.

Hierarchical Order Based on Finality. A human institution, such as a city (*polis*), pursues a specific good which can be defined as its unity or its peace (*tranquillitas ordinis*, according to Augustine). Philosophers have very often been tempted to speak of it metaphorically in terms of an organic body. Indeed, a living being's acts or functions taken as a whole are hierarchically ordered by the ends the living being pursues, and principally by that ultimate end which is its survival; more precisely, according to the greater or lesser role they play with regard to survival. Here too, the ordering principle, which in this case is the end, determines the *value* of every act or function with regard to one another and with regard to the whole they constitute. What is here said of a living being can be extended to ethical life. The acts of a moral subject are in vain if they do not pursue an end. The question that arises in ethical life is that of knowing which good can be the will's real ultimate end, that is, an end which is really good and which is not relative to other ends, but for which the moral subject is prepared to sacrifice his life, beyond the merely physiological imperatives of survival. Philosophers have proposed various doctrines on this issue. But it seems that the moral philosophies which most adequately correspond to the reality of the human condition are those that propose, as an ultimate end to man's moral actions, not mere subjective utility (e.g. J. S. Mill), but either man himself, in as much as he stands as a friend, or God, known and loved through contemplation. These are the ultimate ends on which the unity of a moral person is grounded; it is according to these ultimate ends that he can organize the whole of his subordinate and secondary objective ends, and that he can represent to himself the *system of values* he is ultimately prepared to defend.

Exemplary Hierarchy and Hierarchy of Ends in Political Society. Thus, the hierarchy of ends is not the only type of hierarchy to be found in moral life. Moral life presupposes a hierarchy of values according to law and duty. But this hierarchy of values is itself ordered according to the hierarchy of ends, in a way analogous to the order there is between matter and form. From this point of view, it appears that the Kantian understanding of law and of the categorical imperative implies a 'Copernican Revolution' in ethics, too. It considers duty and law as the moral *form* of human action, and the real good (i.e. the possible end of a moral action) as its mere *matter*. But on this issue, it seems preferable to maintain the hierarchy set forth by Greek philosophy, according to which the exemplary order of law and duty is ultimately ordered according to the hierarchy of ends, the relation between them being analogous to that of a formal instrument to an end. It is only this relation of ordering, not subordination, that can secure an objective hierarchy of values, where Kant's subjective ethical form provides a mere transcendental substitute for this objective hierarchy of values. For, in contrast to this relation of ordering, the relation of subordination abolishes the freedom of the subordinate agent. Still, the controversy between defenders of hierarchy based on legal exemplarity and advocates of hierarchy based on the finality

of the good remains lively in political philosophy. Should one ground the principle of the hierarchical order of political society in law or in the common good, i.e. in the ultimate end of a political community? The first alternative guarantees the formal equality of each person before the law, the second alternative is a basis for the concrete equality of each person in society. Twentieth-century thinkers appear to be gradually discovering an intermediary solution, which is doubtless minimal, but universally practicable: a political constitution inspired by 'human rights' as exemplary values which ensure the individual good in social life.

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ANDRÉ DE MURALT

Hilbert, David

David Hilbert (1862–1943) was, after the death of Jules Henri Poincaré (1854–1912), the greatest mathematician of his era. From 1892 to 1895 he occupied extraordinary and then ordinary professorships in Königsberg, where he received his doctorate (1885) and habilitation (1886). In 1895 he took up a professorship at Göttingen, joining Felix Klein (1849–1925) there, and remaining until his retirement in 1930. It is fair to call him the last of the great universalist mathematicians; he made fundamental contributions to all the major fields of mathematics, including mathematical physics. (For a review, see the article by Hermann Weyl (1885–1955) in the *Bulletin of the American Mathematical Society* for 1944, 50, pp. 612–54.) His importance to philosophers is immense, for he had a lasting interest in the foundations of mathematics; in fact, this was the only one of his interests on which he published throughout his career, his usual habit being to work on and publish in an area, and then to leave it for good. He made seminal contributions to this subject, beginning in the late 1890s with the important work on the foundations of geometry, and culminating in the 1920s with what has become known as Hilbert's programme, the underlying philosophy of which is often called, misleadingly, formalism.

Hilbert insisted that classical mathematics does not need to be substantially revised, and was thus opposed to L. E. J. Brouwer (1881–1966) and, for a time, Hermann Weyl, and also to their antecedent, Leopold Kronecker (1823–91). The last named was one of the leading mathematicians of Hilbert's youth who objected not only to the non-constructive developments due to Georg Cantor (1845–1918) and Richard Dedekind (1831–1916), but also to the mathematical analysis developed and pursued by his colleague and contemporary, Karl Weierstrass (1815–97). (However, as will be indicated, there is a sense in which Hilbert thought Kronecker right.)

Hilbert's main general contribution was to transform the study of the foundations of mathematics into a mathematical discipline, thus creating what we know as metamathematics in general and mathematical logic in particular. Indeed, all the main branches of this latter discipline (proof theory, model theory, recursion theory) have their origins in Hilbert's work. Hilbert was guided throughout by the fundamental principle that the central philosophical problems concerning mathematics should be tackled by making them as precise and as mathematically tractable as possible. It should be stressed that the way in which he achieved this is of interest not just to the philosophy of mathematics, but to analytic philosophy generally, shedding light on central issues in the theory of meaning, in the current debates on realism, and in the philosophy of mind. One way of underlining this indirectly is simply to note Hilbert's profound influence on the logical positivists, and on Rudolf Carnap in particular.

To turn to Hilbert's treatment of foundations itself, the thread which links all periods of Hilbert's concern is the notion of consistency. The early work stressed the fundamental philosophical position of this notion;

the later work, reaching its climax with Kurt Gödel's incompleteness theorems in 1931, made the study of proof a mathematical one, and proposed dealing with consistency in a mathematically elementary and direct way. The place to begin consideration of Hilbert's work on foundations is his work on geometry, and in particular the important debate on the purpose and status of axioms, and on the existence of mathematical objects, in his correspondence with Gottlob Frege.

According to Frege, the axioms of a science should be fundamental truths about the basic objects of that science. This leads to the position that one should know what the sense and the reference of a term are *before* one can frame axioms which contain that term. Hilbert claimed that we don't need to do this, that the axiom system as a whole acts as an implicit definition of the key terms in it (terms like 'point', 'line', 'plane'), and this was the approach he adopted in his *Grundlagen der Geometrie* of 1899. Indeed, geometry provides a good test case. Consider arithmetic for a moment. Suppose one accepts the view, as Frege did, that numbers are extensions of a certain kind. Then it seems possible, and actually feasible, to ask of the basic principles of arithmetic whether they are indeed *true* of numbers so construed. However, in the case of geometry, it is difficult to see how the process can even begin, for one would first have to say, for example, what points *are*. Hilbert's view was that this will lead to confusion, for it will tempt us to explain points as extensionless or to use other hazy or empty locutions. If we return to the case of numbers now, we see something similar. As long as numbers are to be taken as extensions, asking whether the axioms of number theory express truths about number-extensions seems to make sense, providing we have precise principles governing extensions. But it seems difficult, if not impossible, to answer the question as to what extensions themselves are, i.e., what their essence is. (Witness the set-theoretic antinomies.) Hilbert's view was that, in addition to being ultimately fruitless, such exercises are unnecessary. We can proceed with everything we would want to do in the mathematical study of geometry, or even set theory, without having to answer this type of question. Of course, questions concerning the existence of abstract objects are important, as opposed to questions about their *nature*; but Hilbert claimed that such questions can simply be replaced by that of the *consistency* of the axioms governing them. One can detect a strong anti-metaphysical bent here, similar to that which permeates much of Ernst Mach's writings, and which was to be adopted in a strong form by the logical positivists. Indeed, much in Hilbert's views on these matters is reminiscent of the views of Heinrich Hertz (1857–94) and Ernst Mach (1838–1916) on the role of theoretical terms in physics.

As is clear, this position lays stress on the notion of consistency. But if concentration on consistency is to replace metaphysical concern with semantic notions like truth and reference, how is the consistency question for theories to be tackled *mathematically*? One approach can be seen in Hilbert's work on geometry, for much of this was concerned with the question of exactly which axioms are needed for the proof of specific theorems, and with the related question of the independence of various axioms. Consequently, to answer these questions, Hilbert's work exhibits a sequence of relative consistency and independence proofs, and, in doing so, it produces 'models' of various systems of geometrical axioms in various types of algebras of systems of numbers; in other words, models of the geometric in terms of the arithmetic. What this shows, as Hilbert pointed out in his famous lecture to the International Congress of Mathematicians in Paris in 1900, is that any contradiction provable in the geometrical systems must be matched by a corresponding contradiction provable in the arithmetical systems. This provision of models is quite in line with the shift from semantic questions to syntactic ones. It is not to say that mathematics is simply concerned at root with the formal manipulation of symbols. Rather, this shift underlines the metaphysical position Hilbert had adopted towards Frege, for it implies that the aim of a mathematical theory is not to describe a realm of independent facts, either given by the natural world (as might be

thought to be the case with geometry), or in some other abstract, theory-independent way. Thus, given this view that models of mathematical theories are not construed as theory-independent realms of facts built up around (mathematical) objects, what consistency proofs of this type do is to exhibit the translation of the terms and sentences of one *theory* into those of another. In addition it stresses that the providing of interpretations does not change the basic meaning of the theories interpreted. Terms, and thus theories, do not gain and lose meaning as they gain and lose possible referents.

However, the suggestion that, by acting as a source of models, arithmetic is to establish the consistency of all other theories (even physical theories, Hilbert claimed) exposes arithmetical theories themselves, for the consistency question for these theories, once axiomatized, clearly cannot be answered in this way if the various claims that rely on the notion of consistency are not to be circular. In the 1900 address mentioned above, Hilbert proposed a list of twenty-three problems from all domains of mathematics. Second on this list (solving Cantor's continuum problem was first) was the problem of specifying a direct way of showing that the axioms of 'arithmetic' (i.e., the theory of *real* numbers) lead to no contradictions. This creates both the mathematical problem of proving consistency directly, and also the philosophical problem of explaining just why arithmetic is fundamental in this way. Hilbert's programme addresses both questions.

The programme relies on one central assumption and one central insight. In the first place, it assumes that mathematics can be formalized in a sequence of axiomatic systems. In effect, this was a generalization of Hilbert's success in providing both axiom systems for geometry and for the theory of real numbers (published in 1900). This was followed by various axiom systems for other branches of mathematics, in particular for set theory, following the work of Ernst Zermelo (1871–1953) in 1908, and later that of Abraham Fraenkel (1891–1965), Thoralf Skolem (1887–1963), John von Neumann (1903–57), and others in the 1920s. (It should be stressed that Hilbert's was not the only influence pressing in this axiomatic direction.) The insight is that if these theories, and deductions in them, are viewed as combinations of symbols – that is, if we abstract from their content – then they become combinatorial systems in which the construction of a proof amounts to just the application of a finite number of rules of inference to a precisely specifiable list of sentences laid out at the beginning (the 'axioms'). In this framework, the problem of consistency can be posed as a purely combinatorial problem, the problem of whether there is a 'proof combination' which ends with a particular 'symbol combination', say '0 = 1'. Thus, the consistency question (and with it the question of the existence of mathematical objects) is mathematicized, at least potentially, in line with Hilbert's fundamental principle.

The central conjecture proposed by Hilbert's programme is that the question of consistency can not only be posed but *answered* by elementary arithmetical means suitable to the combinatorial nature of the axiom systems. This crucial conjecture relies on the *philosophical* reasons given as to why parts of arithmetic *are* fundamental.

It is clear that, if the consistency question is to be answered mathematically, then it has to be answered using some theory of arithmetic. (Gödel confirmed this by showing unequivocally that consistency can be framed as an essentially arithmetic question.) But if the consistency question is to be answered for the full arithmetic of the natural numbers (say, the Peano theory), then a proof will only be suasive if we use a *weaker* arithmetic in carrying out the proof, and only then if the weaker theory itself is accepted as consistent. Hilbert was clearly aware of these possible stumbling blocks. He conjectured that the consistency question for full arithmetic can indeed be answered by reliance on a weaker theory, but on a theory which is sufficiently weak that its consistency does not require a proof, i.e., is self-evident. This arithmetic is called 'finitary arithmetic'.

It is not entirely clear exactly how finitary arithmetic is to be understood. However, four things *are* clear. First, finitary arithmetic is to be much weaker than theories accepted by the intuitionists. Second, this arithmetic is

to be contrasted with the bulk of classical mathematics, which Hilbert called 'ideal', and the two are to be distinguished by the fact that the former is to contain no direct or indirect reference to infinite totalities, i.e., no terms standing for such totalities and no unbounded quantification over them. Third, the reason for this division is two-fold:

1. It is claimed that there is no way of giving any physical content to the assertions, even indirect, that infinite totalities exist, for it is quite possible that everything in the physical world is finite in nature. Any such existence claims are, in this sense, abstract, and classical mathematical theories essentially ideal in nature. Consequently, in line with the earlier approach, any existence claims can only be established by proving the consistency of the theories which embody them.
2. Hilbert clearly recognized that the understanding of any theory whatsoever presupposes such 'finitist' ability, for it must presuppose the ability to treat the symbols of a language themselves as discrete objects, and to differentiate concatenated strings of them. He thus proposed using this *sine qua non*, however it be formulated, as the ultimate source of consistency proofs.

This represents Hilbert's fundamental agreement with Kronecker on the primacy of the natural numbers, though, for Hilbert, it was an agreement which does not involve the sacrifice of any part of classical mathematics. It is worth pointing out that this is the origin of the view that the mind works in a *computational* way, at least in part. It can also be seen as a weak version of Kant's doctrine of outer sense, with the claim that outer intuition depends on Euclidean geometry replaced by the assertion that, whatever else it may require, outer intuition presupposes the ability to differentiate finite sequences of discrete objects. Fourth, Hilbert conceived of the relation between finitary and ideal mathematics in analogy with the extension of existing theories by the addition of ideal elements or statements, for instance, of the point at infinity to geometry.

Given this, the proposal is then to prove the consistency of ideal theories via a *conservativeness* claim concerning them. To say that an ideal theory is conservative over a finitary theory is to say that, given a statement formulated in the language of the weak, finitary theory which is known to be provable by the ideal theory, then it must be provable by the finitary theory as well. This entails consistency, for the statement '0 = 1' certainly belongs to the language of finitary arithmetic, and cannot be derived from this weak theory. Hence, if we know that a given ideal theory is indeed conservative over the finitary theory, then we would also know in particular that the statement '0 = 1' cannot be proved from it either.

However, the two incompleteness theorems published by Gödel in 1931 show that these claims *cannot* hold. From the second theorem in particular it follows that, if full arithmetic is consistent, then even this theory itself would not be strong enough to prove this. Most ideal theories are therefore *not* conservative in the sense that Hilbert thought. One way of encapsulating Gödel's discovery is to say that his work confirms the combinatorial nature of the consistency problem, but shows that the possible complexity of proofs in an ideal theory such as Peano arithmetic is a function of its actual provability strength, and not independent of this strength as Hilbert's conjecture implies.

It is often thought that Gödel's theorems refute Hilbert's programme. These theorems *do* show that consistency cannot be proved in the way that Hilbert thought. However, the claim that they refute the programme has to be tempered.

In the first place, mathematics has become by and large axiomatic, as Hilbert insisted it should. Moreover, Gödel's work itself makes clear *how* we can treat the consistency question in a combinatorial, indeed, arithmetic, way, via a mapping of the syntax into the natural numbers (Gödel numbering). It also begins to isolate an elementary arithmetic theory in which it is possible to carry out this combinatorial work, in particular in which to pose the consistency question for

any first-order theory whatever, within certain broad limits. This has become known as *primitive recursive arithmetic*. (It has been argued that this satisfies precisely what Hilbert took finitary arithmetic to be. See Tait 1981.) The precision which Gödel's work exhibits is thus not only fully in the spirit of Hilbert's approach to philosophical questions about mathematics, it actually seems to confirm the approach of the programme. Because of his theory of ideal versus finitary mathematics, Hilbert has sometimes been treated as an instrumentalist, a view according to which the function of an ideal theory is nothing other than to provide derivations of true finitary statements while being in itself meaningless. Gödel's theorems indicate that we cannot abide by the finitary alone as being the meaningful part of mathematics, for 'ideal' theories are *not* conservative, and thus we cannot automatically ignore their meaning. Thus, it is contended that these theorems refute instrumentalism. But Hilbert was not an instrumentalist in this sense, although he was certainly influenced by the belief of the influential 19th-century mathematician Peter Gustav Lejeune-Dirichlet (1805–59) that statements of higher mathematics can be expressed as statements about the natural numbers, and also by Kronecker's insistence that the natural numbers are primary. But he did not accept the view that *only* statements solely about the natural numbers have meaning, let alone just those of finitary arithmetic. His stress on the consistency of the ideal theories is really an attempt to provide specific criteria for the acceptability of a theory, and his doctrine of ideal elements must be seen in this light, strongly connected as it is to the views of Cantor and Dedekind on acceptability and the integration of new theories into the existing corpus of mathematics.

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MICHAEL HALLETT

Hildebrand, Dietrich von

Dietrich von Hildebrand (1889–1977) was a member of the Göttingen circle of phenomenologists influenced by Edmund Husserl (1859–1938), Max Scheler (1874–1928), and, above all, by Adolf Reinach (1883–1917). His primary fields are ethics and epistemology. Among his main works are: *Metaphysik der Gemeinschaft* (1930), *What is Philosophy?* (1960), *Ethics* (1978), and *Das Wesen der Liebe* (1971).

In the order of their role in his work, his primary contributions to ontology and metaphysics include the following.

Ontology of Value. The traditional notions of good and of value correspond in Hildebrand to that of 'positive importance'. Importance is here contrasted with what is neutral either in itself or with respect to our motivation. A thing can be positively or negatively important. Within positive importance, Hildebrand distinguishes in his *Ethics* three radically different categories: the merely subjectively satisfying; that which is objectively good *for* a given person; and value proper, which he understands as intrinsic positive importance. '*Intrinsic*', here, means a special character of importance itself, and is to be identified neither with the ontic autonomy of its bearer (in Roman Ingarden's sense), nor with the importance of the end as opposed to that of the means. Intrinsic positive importance means an inherent goodness or preciousness which is neither relational nor relative to a subject nor dependent on it. What is good in the sense of value is simply speaking good and not only good 'for someone'.

These distinctions allow Hildebrand a radically objective ontology of value. While

all three types of positive importance can have the character of an objective property of being, this is true most of all of value as inherent intrinsic goodness. Value is wholly independent of appetites, subjective valuations, feelings, etc. In a way which recalls G. E. Moore's and D. F. Ross' views on the definable and consequential nature and the objectivity of good, Hildebrand speaks of the irreducible datum of the good (of value). Hildebrand goes further than Moore and Ross, however, both in his elaboration of the objectivity of the good in the light of his distinctions between the three categories of importance and also in his detailed criticisms of value-relativism, ethical relativism, aesthetic subjectivism, and of the traditional theory of the good as *appetibile* (Crosby 1977).

In his philosophy of objective value, Hildebrand seeks to provide the ontological and epistemological basis for what Franz Brentano called a 'love that is characterized as right' (*als richtig charakterisierte Liebe*). The subjectively satisfying is, Hildebrand argues, so dependent on the subject that it cannot ground a correctness and justness of our response in the manner intended by Brentano. Even some objective goods *for* the person (for example, water for the thirsty) depend on drives, inclinations, etc. in the subject *for* whom an object is important. Only value is entirely objective and does not contain any 'for'. Yet precisely because of its objectivity, value can become the foundation of objective goods which address themselves to the individual centre of the person for whom they are objective goods. Hildebrand's detailed account of the different marks of moral and other values allows him to elaborate an objective hierarchy of values and to establish the sense in which moral values are of a higher rank than non-moral values. Hildebrand's ontology of objective value is complemented by an epistemology of many kinds of value-cognition (*Wertnehmen*) and of value-blindness and by a critique of various substitutes for true moral values. Especially noteworthy are the parallels between Hildebrand's philosophy of value and John Duns Scotus's critique of the Thomistic thesis of the relationality of the *bonum* to *appetitus* and of Scotus's insistence that the *bonum* is a transcendental *in se*, rather than only *ad aliud* (Seifert 1989). Important also is the critique of David Hume's and of George Santayana's value-relativism and subjectivism contained in Hildebrand's *Aesthetics*. Hildebrand's ontology of value in general is complemented by his investigations, sorely missing in Moore, into moral and necessarily personal versus non-moral values and goods and into the irreducibility of moral value to a means towards non-moral goods or towards happiness. At the same time, Hildebrand's category of 'morally relevant goods' allows him to fully recognize the close connection between moral values and nonmoral ontic and qualitative values, to elaborate three ontologically distinct modes of participation in value, and to make other significant contributions to axiological ontology.

Metaphysics of the Person and of Community. Hildebrand developed also an ontology and metaphysics of the person and of community. He criticizes in depth (mostly in his unpublished writings) a metaphysical confusion which dominates philosophy from Plato to the 20th century: the confusion between the 'mental' (*das Geistige*) and the mind (*der personale Geist*). Ideas, abstract concepts, and judgements are radically distinct from the living individual mind or spirit. Erroneous ideas such as that the soul is similar to the forms or is something like an 'individualized general form', or that the soul will be an abstract essence after death, or that it is a transcendental logical subject, etc., result from this confusion and obscure the nature of the person, which in Hildebrand's metaphysics takes on the central position of substance in Aristotle (see Seifert 1989).

The person, for Hildebrand, is the focal point of the universe, a substance in a more important sense than things of other sorts, a world unto itself. Intentionality – understood as a conscious and meaningful relation between a subject and an object – and rationality in a broad, non-rationalistic and non-restrictive sense of *Geistigkeit* or rational meaningfulness, characterize not only intellectual and volitional responses but also various spiritual forms of affectivity.

Many other features of the person – especially freedom and moral values and the capacity for love – are studied in detail by Hildebrand. The person, he argues, cannot be understood eudaemonistically, as striving for self-actualization. Rather, he is a transcendent being called upon to conform his intellect to reality and his will and affective responses to the goods which possess intrinsic value and demand a due response. Yet far from losing his own self in value-response, the transcendence of value-response leads to happiness as its superabundant fruit.

Hildebrand continues Reinach's analyses of social acts by analysing a unique type of acts among the sort of acts which are in need of being heard: "the act of simultaneously revealing and 'uttering' an act (*Verlautbarung*), which has the same person as its object and addressee". It is of the essence of such an act of *Verlautbarung* that it is registered, taken up by the very person who is its object. From mutual *Verlautbarung* and also from other material and formal factors there result not only legal bonds such as claims and obligations (Reinach 1989) but also communities. The latter are ontologically dependent on persons but they are *indefinable data* (*Urgegebenheiten*) in their own right. Hildebrand presents a comprehensive phenomenological ontology and axiology of community which emphasizes the irreducible nature, value, and rights of the individual as much as the value of community. Hildebrand also criticizes that sort of individualism which falsifies the social nature of man. At the same time, however, he developed in the 1930s a sharp critique of national socialism and also the outlines of a critique of Hegel and Marx as well as of all forms of totalitarianism.

General Ontology and the Ontology of *Sachverhalte*, *Wesenheiten*, and Things in Themselves. Inspired by Reinach, Hildebrand developed a phenomenological ontology of states of affairs, seeking to show that certain values or disvalues (e.g., moral ones) can be borne only by persons, others – such as the tragic or *das Erfreuliche* (gladsomeness) – only by states of affairs, i.e., by structures of the form: *A* is *b*, *A* is not *b*, and so on. In criticizing Kantianism and Husserl's later transcendental phenomenology, Hildebrand presents an ontology and epistemology of *necessary essences* which he distinguishes from various sorts of non-necessary such-being unities and from purely accidental so-being. The absoluteness of the necessity of the essence of morality, of value, of the person, of being as such, etc. forbids their interpretation as subjective forms of consciousness or as constituted and mind-dependent *noemata* in any sense. Such essences characterize things in themselves and possess an ideal existence wholly independent of human consciousness. Their intrinsic and absolute necessity is intelligible and evident to our intellect. In the *cogito*, as well as in the justifiability of sense perception, also real beings and the world as independent from conscious acts are given with various kinds and degrees of indubitability. From such a basis, a realist phenomenology and ontology become possible.

Hildebrand's *Nachlass* contains several longer manuscripts on the metaphysics of substance, of accidents, of absolute being, etc., and also a careful treatment of the ontology and phenomenology of causality and of the metaphysics of the will and affectivity. His published work also contains contributions to a metaphysics of death and immortality. Hildebrand develops also an ontology of the work of art, of historical epochs and ideas, and other substantial parts of ontology. Some of his students made, in Hildebrand's spirit, contributions towards a more complete general ontology and systematic metaphysics of the person than Hildebrand has left behind, thereby also demonstrating the fruitful dynamism of his thought and integrating his work more fully into traditional and contemporary contexts of discussion.

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JOSEF A. SEIFERT

Hobbes, Thomas

Thomas Hobbes (born in Westport in 1588, died at Hardwick Hall in 1679), English philosopher, is chiefly remembered as a political theorist and as the writer of *Leviathan* (1651), a study on absolute sovereignty. Yet he had many other interests, including mathematics, physics (especially optics), and history. From the slow start of his career as a philosopher in the 1630s, Hobbes was driven by the urge to provide an indubitable basis for knowledge and to show how from that foundation a coherent system of sciences could be derived. That ideal is pre-eminently embodied in his trilogy on the elements of philosophy consisting of *De Corpore* (1655), a work on bodies as such; *De Homine* (1658), treating of human bodies; and *De Cive* (1642), a study of political bodies. Most of his works met with solid opposition. Nevertheless his ideas had a strong influence on moral and political philosophy.

Traditionally, philosophy was conceived of as a theoretical science of objective, unchangeable, and eternal essences. Hobbes replaced this sublime view with the mundane idea of philosophy as a logical system, constructed in the service of man, of applied sciences concerning natural phenomena. Inspired by Galileo Galilei's theory of motion and by Euclid's axiomatic-deductive method, he tried to integrate empiricism and rationalism in a comprehensive doctrine. This resulted in a philosophical system based on a materialistic-mechanistic metaphysics and on a theory of language conceived as an instrument of cognition.

According to Hobbes, reality consists of nothing but a collection of singular, material bodies. Thus he firmly rejects the idea of immaterial substances. By bodies he understands material entities that, independently of our thinking, coincide with some part of space, and are distinguished exclusively by motions which differ according to the way they are generated or produced. This means that not only natural phenomena but also the construction of geometrical figures can be explained in terms of matter in motion. The same holds good for the causal explanation of psychological processes like perception, recollection, or thinking, and indeed of sociopolitical phenomena. Thus Hobbes extends his mechanistic view from physics to geometry as well as to the behavioural and social sciences. He conceives reality, including states of consciousness, as a network of efficient as well as material causes and effects that is completely determined in the sense that it leaves no room for final causes. Freedom means nothing but the absence of external coercion.

In Hobbes's view, not the world itself but our ideas of reality constitute the proper object of science. Accordingly he begins his natural philosophy with a detailed analysis of these ideas, which issues in the conclusion that ultimately all sciences can be reduced to one and the same set of concepts, primarily those of space, time, quantity, and motion. These concepts, derived from sensation, constitute our most general ideas and are to be considered as the elements of philosophy. Thus all knowledge starts with the senses. These, however, inform us only about the effects of external objects on the sense-organs, without telling us anything about those objects and their actions themselves, that is, about the causes of sensation. Perceptions contribute, in other words, only to experience – that is, knowledge of facts; while the acquisition of causal knowledge – that is, science – requires reason.

By reason Hobbes means a kind of mental arithmetic – that is, addition and subtraction, also called composition or synthesis and resolution or analysis – of ideas. These, however, in view of their inconstancy and transitoriness need to be named or fixed by words, arbitrarily chosen marks which function as aids to memory and as signs which enable us to convey our thoughts to others. Hobbes's nominalist conception of reality as a collection of concrete, singular bodies

implies that by universals he understands nothing but names that signify more than one thing. This means that the scientist, in search of universal truths, 'calculates' only with words. Such calculation is carried out on the basis of strict definitions and according to the rules of logic. On the one hand, the scientist deduces effects from known causes by the combination of simple names. On the other hand, he infers possible causes from known effects by an analysis of complex names. Confining his enquiries to those bodies whose generation lends itself to conceptual analysis and synthesis, and knowing how to range his words, the philosopher methodically reveals the truth, understood not as a property of things but of our judgements of them.

Accordingly Hobbes characterizes philosophy as an art based on words leading to the knowledge of consequences of names, that is, necessarily true conclusions. Now the causes of natural bodies, in contrast with those of artefacts like geometrical figures or forms of government, cannot be known with absolute certainty. Only of man-made things do we know exactly how they are produced. Consequently Hobbes distinguishes geometry and civil philosophy as apodictic sciences from the natural sciences which bear a hypothetical character.

Yet all sciences, in Hobbes's view, constitute a deductively organized system, dealing respectively with motion as such (geometry), visible motions between bodies (natural philosophy), and the invisible motions within bodies (civil philosophy). Science derives its unity from the elementary notions, collected and defined in what Hobbes calls, using the traditional expression for metaphysics, 'first philosophy'. As opposed to the Peripatetics, however, he understands by this not the science of beings *qua* beings, but a true, proper, and accurate nomenclature of things. As a methodical prerequisite of science it precedes philosophy and articulates the logically constructed building blocks of reality as an object of knowledge.

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JAN PRINS

Holism

If we inductively infer the future conjunction of two events (the rain falling, the ground becoming slippery) from the regular occurrence of such conjunctions in the past, then, when once the anticipated conjunction begins to fail to occur, the expectation disappears. When we deduce a prediction from a set of hypotheses, however, the situation is quite different. Here, the failure of the prediction entails that one of the hypotheses at least is wrong, but it does not tell us which. To borrow a well-known example: from the fact that the prediction expressed by the sentence 'The decks of a receding ship will not disappear from view before the masthead' is refuted by observation, we can infer only that one at least of several hypotheses which together imply it is false (such as, e.g., 'The earth is flat', 'Light rays follow a rectilinear path').

The French physicist and historian of science, Pierre Duhem (1861–1916), claimed that it is the second situation that prevails in physics:

> To try to separate each of the hypotheses of theoretical physics from the other suppositions on which this science rests, in order to submit it in isolation to the test of experience is to pursue a chimera . . . The only experimental test of physical theory that is not illogical consists in comparing the entire system of physical theory with the whole set of experimental laws . . . (Duhem, *La théorie physique, son objet et sa structure*, 1906).

Duhem does not, however, extend this claim to other sciences such as physiology, or to our common-sense knowledge.

Quine's Holism. In his *Methods of Logic* (1952), W. V. O. Quine stated that: "Our statements about external reality face the tribunal of sense experience not individually

but as a corporate body". This broadened holism rests on the view that all parts of science are connected in so far as they share logic and some mathematics. Quine therefore *extends* Duhem's holism. But he also *mitigates* it:

> . . . the Duhem thesis would be wrong if understood as imposing an equal status on all the statements in a scientific theory and thus denying the strong presumption in favour of the observation statements. It is this bias that makes science empirical (Quine 1975).

Quine advocates both epistemological holism (no sentence is verifiable or falsifiable in isolation) and semantic holism (no sentence has a separable empirical content); the second is narrower in scope. Quine only maintains that "*many* scientific sentences inseparably share empirical content" (Quine 1986), he does not claim that *all* do.

Holism Versus Individualism in Social Sciences. Social scientists make statements about groups, institutions, cultures. The question arises whether the latter statements can be reduced to or translated into statements about the individuals who are members of these groups or who act within these institutions or cultures. Individualists give an affirmative answer. Holists give a negative answer. Reluctance to admit holistic explanations springs from the fear of reifying abstractions. Neo-classical microeconomics provides an illustration of methodological individualism. The macrostates of the market are seen as resulting from the dispositions and actions of individual producers and consumers. The explanation of behaviour in terms of *esprit de corps* illustrates methodological holism: ". . . to say that *esprit de corps* has influenced an individual is not to say that he has been influenced by isolable individuals or their acts" (Gellner 1968). One might, however, object that what is acting here upon the individual is not so much a whole as such but a mental representation of a whole.

Three Claims Associated with Holism. A first claim of holism is that the whole is not reducible to its parts and that interaction between parts produces new properties (emergence). The second claim is that the parts cannot be understood in isolation from the whole to which they belong. A third claim is that the knowledge of the whole cannot be obtained by placing the contents of the knowledge of the parts side by side. Before trying to assess these claims one should first examine how holists construe the part–whole relation.

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PAUL GOCHET

Hume, David

David Hume was born in Edinburgh on 26 April 1711. Being one of the most impressive representatives of the Age of Enlightenment, he not only sought to revolutionize the study of human nature, but also made major contributions to a great variety of areas of research, including political theory, economics, religion, and sociology. Above all, however, Hume has to be regarded as a philosopher who was also a great and very influential historian. In fact, regarding Hume as philosopher *and* historian gives us a clue to understanding the essential features of his philosophy. Apart from being an author, which was the major passion of his life, he also started a political career ending in the position of an undersecretary of state, and for a couple of years he served as the librarian of the Faculty of Law at Edinburgh University. Hume died in Edinburgh on 25 August 1776.

Hume's major works include his early masterpiece *A Treatise of Human Nature* (1739–40), the *Enquiry Concerning Human Understanding* (1742), the *Enquiry Concerning the Principles of Morals* (1748), several collections of essays, the *Dialogue Concerning Natural Religion* (1779), and the six-volume *History of England*.

All these different works are devoted to the realization of the central aim of the enlightenment project: the destruction of prejudices and ideologies. What Hume was most interested in were those prejudices which concerned 'human nature' (one of the key concepts of his philosophy). A true child of his age, Hume strongly believed in the methods of natural science as developed by e.g. Galileo, Francis Bacon (1561–1626), and Newton. His all-embracing plan was therefore the establishment of a science of human nature based on the methods of the Newtonian natural science. Accordingly he tried to explain human nature by finding those few simple and basic laws that govern human thought and human behaviour. The most essential insight which he gained both by reflection and by his historical studies was an anti-rationalistic philosophical idea of man. Man, according to Hume, is not governed by reason, but by his passions. As he puts it in the *Treatise*: "Reason is, and ought only to be the slave of the passions, and can never pretend to any other office than to serve and obey them".

This feature of his philosophical anthropology, which Norman Kemp Smith called 'naturalism', may be regarded as one of several sceptical ideas characterizing Hume's epistemology, ethics, theory of religion, and most of his political essays. These sceptical ideas are based on his conviction that human reason is weak and that one must not expect too much from the moral behaviour of a being that is governed by his passions.

The most famous of these sceptical elements, is, however, Hume's theory of causation. The main thesis of this theory is sceptical, because it denies the possibility of causal knowledge. What we know about the relation of cause and effect is only a psychological mechanism governing our mind. This mechanism, based on custom, leads us to expect an event *B* following *A* just because we have experienced such a sequence of events sufficiently often in the past. But, having no knowledge as to the material powers connecting *A* and *B*, and having no guarantee that nature will be the same in the future as we have experienced it up to now, we do not have a logical foundation for our causal convictions. The method of induction, therefore, can be applied only tentatively. Its sole justification is pragmatic: behaviour based on custom has proved successful. But custom cannot be the foundation of knowledge in the dogmatic (rationalist) sense of the word. Instead, Hume insists, we must accept that all our endeavours in philosophy, science, and history will lead us to nothing more impressive than beliefs, based on custom and dignified only by their pragmatic success.

Hume's pragmatism does not express itself only in this respect. Pragmatism is also his main weapon against scepticism in its most radical form: Pyrrhonism. Arguing against such radical scepticism, Hume develops an idea which I propose to call 'Hume's theory of the sceptical paradox'. This paradox consists in the fact that the sceptical arguments 'admit of no answer and produce no conviction'. Scepticism admits of no answer in the sense that we cannot find a foundation for our knowledge that would resist any serious sceptical doubt. But nevertheless, scepticism does not convince, because as pragmatic beings governed by passion we tend to think that the failure of our reason to prove scepticism wrong does not prove scepticism right. It only makes obvious that reason is not reliable; but in a way it does not need to be, for we do, after all, get along quite well with a less than perfect intellect.

Pragmatism as a weapon against scepticism also determines the main features of Hume's ethics. His moral reflections do not seem to be guided by the question: what am I to do? Rather Hume seems to be occupied by the question: how is it possible to make people do what they ought to do? This is an essential problem for a realistic ethics in the Humean style, because it refers to the conflict underlying all ethical reflection, the conflict between the social character of man and his selfishness. For Hume it is obvious that there can be only one way to reconcile these antagonistic powers. A man will never do good just for good's sake; the philosopher must prove to him that it is in his own interest to do good. Hume's argument in this context is the following: everyone wants to lead a happy life; and he also wants some share of

happiness for his family and his friends. In order to be happy he must, however, be secure from the malice of bad people. Therefore, beside his own liberty and that of all fellow beings, he needs order. The antagonistic powers of liberty and order can only be brought into some kind of equilibrium if everyone is prepared to accept some social values as obligatory. The most central of these social values is justice. Therefore it is in everybody's interest to preserve justice and to make others preserve it, and from justice there follow most of the other relevant virtues. In fact, it seems to me that Hume's ethics is a theory about those virtues which are necessary to preserve a stable social order.

Pragmatism also determines Hume's discussion of religion. The most interesting aspect of his criticism of religion – making itself felt most clearly in his *History of England* – is his social criticism of religion and the churches. Its main idea is Hume's historically supported conviction that religious ideas are in such immediate connection with the passions guiding human action that religious conflicts tend to be ruinous to social order and stability. It is because of these antisocial effects of religious enthusiasm that Hume says in the *Treatise*: "Generally speaking, the errors in religion are dangerous; those in philosophy only ridiculous". Philosophical errors are not dangerous, because they are not accompanied by passions guiding human action.

Hume's attitude to religion seems to be characterized by several sceptical ideas. Each applies to a different kind of religion and proves its specific weakness. First, there is a kind of sceptical doubt that is directed by Hume against the concept of miracles – and miracles having been proved impossible, it is obvious that there can be no convincing kind of religion based on revelation. Second, there is a kind of scepticism that is directed against the religious conviction typical of many men of letters in the period of the Enlightenment: deism or natural religion. The weakness of this kind of religion lies in its dependence on certain proofs of the existence of God. In the *Dialogues Concerning Natural Religion*, the most celebrated of these proofs, the so-called argument from design, is presented in such a way that no serious person would be inclined to found his religious conviction on it.

Therefore, it would certainly be inadequate to call Hume a deist, without specification. I think, G. Gawlik is right when he calls Hume a critical, but not a constructive deist. Hume accepts all criticism of traditional religion as formulated by the deists without becoming a deist himself. Rather, he seems to have remained a religious agnostic throughout his life.

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RUDOLF LÜTHY

Husserl, Edmund
I: The Early Husserl

Edmund Husserl was born in Prostejov (Prosnitz), now in Czechoslovakia, in 1859; he completed the German Gymnasium at nearby Olomouc in 1876, and for the two years following attended lectures at the University of Leipzig. In 1878 he transferred to Berlin where he was deeply influenced by Friedrich Paulsen (1846–1908) and Karl Weierstrass (1815–97). He entered the University of Vienna in the summer of 1881, finishing his doctorate in mathematics under Königsberger in the autumn of 1882 with a dissertation on the theory of the calculus of variations. After military service he came in 1884 under the influence and teaching of Franz Brentano, who resolved his long-standing vacillations between mathematics and philosophy in favour of the latter and, a few years later, sent him to Carl Stumpf in

Halle for habilitation in philosophy. There he became *Privatdozent* in July of 1887. He moved to Göttingen as extraordinary professor in 1901, and to an ordinary professorship in Freiburg in 1916, where he retired in 1929. He died in Freiburg in 1938. His work is generally regarded as the primary source of the Phenomenological Movement in contemporary philosophy.

Husserl's first philosophical project derived from his mathematical studies under Weierstrass, whose concern for the logical clarification of mathematical knowledge he came to share. Such clarification he took to involve:

1. analysis of the concept, or elucidation of the essence, of number, and
2. rational justification of every aspect of the algorithm used in mathematical analysis.

To begin with he restricted his attention to arithmetic alone, resulting in the *Philosophie der Arithmetik* of 1891 (*Husserliana*, vol. XII). Its first or 'psychological' part elucidates the essence of number, while its second or 'logical' part attempts, without success, to provide an understanding of how the most elemental parts of the symbolisms of mathematics serve to establish arithmetical truths.

With respect to the concept and essence of number, Husserl's method was to select clear cases from the extensions of the concepts of particular numbers, and then, through a process of comparison and analysis, to determine what it is about the given case that constitutes it *as* a case of the particular number. What, for example, does *being three* amount to in those things which are three in number, say the group of pencils on this desk? In every case of a number of objects, some objects will be 'inside' the whole to which the number applies, and others outside. The whole constituted by that fact will be of a type which can take any kind of entity whatsoever as its parts, since every type of entity is numerable. The analysis of number must focus, accordingly, not on the parts, whose nature is of no significance, but upon the interrelationships which they have *as* parts of a 'totality' (*Inbegriff*) of three things. This relation is given the name 'collective combination', and the first part of *Philosophie der Arithmetik* is devoted to clearing up its precise nature. Husserl holds that this relation and the peculiar type of whole ('totality') which it founds are directly given to consciousness; however, mistaken accounts of it still must be refuted and an essential characterization provided for it, as well as for the acts of cognition in which it is 'itself given'.

The collective combination cannot be identified with any relation commonly recognized in philosophical discussions, and belongs, in fact, to a new class of relations, which he unhappily decided to call the class of 'psychical' relations – after its most prominent member, the intentional union of act and object, which Brentano had chosen as one characterization of the psychical over against the physical. The 'psychical' relations have three essential features:

1. There is complete variability as to one or more of their terms.
2. The intuitive grasp of them is founded upon a reflective apperception of a relevant act or acts of consciousness.
3. In that cognitive grasp there will be no 'primary content' or *sensum* corresponding to the 'psychical' relation in question.

All three features hold true for the paradigm of the class, of course, the *intentional union* itself, but also for the *difference* perceived to subsist between things judged to be non-identical, and for the *collective combination* perceived to unify a totality of a certain number of things. What is here called 'psychical' is in Husserl's latter terminology the 'formal', since it effects no modification of the matters which it interrelates.

These are the three relations mentioned by Husserl as belonging to the class of 'psychical' relations. (His discussion of the categorial *property* of being a mere 'something' proceeds along similar lines. *Husserliana* XII, p. 80.) It is to be noted, however, that only the intentional *union* is 'mental' in any ordinary sense of the term. The choice of terminology in calling the collective combination 'psychical', while explainable, was little short

of disastrous. As Marvin Farber and others have long recognized, the collective combination and the resultant whole is not a part of the mind; and the terms which it unites are not necessarily mental, nor are they intentionally directed upon one another as in the case with the mental act and its object. But the theory of number Husserl advanced has generally been misunderstood – most notably by Gottlob Frege – as implying that number is subjective or mental. Nevertheless, Husserl was quite clear as of 1891 that in his analysis of number he was dealing with the objective, categorial features of objects (*Husserliana* XXI, p. 84), though features which are given only to acts of higher order, acts which contain other acts as parts.

In the 'psychological' part of the *Philosophy of Arithmetic*, Husserl not only explicates the concept and essence of number, as the general type of structure found in all particular numbers, but provides the same kind of 'psychological' analysis for the relations of *more* and *less* as found between the smaller numbers (Chapter V). With this done, he has also brought the lowest part of the number *series* before us, providing the intuitional base from which we can and do proceed to think and know, with the aid of appropriate mathematical symbolisms, the whole domain of numbers, "an unlimited manifold of species", which constitute "the numbers in themselves" (*Husserliana* XXI, pp. 222, 260). But here the 'psychological' work must end. It is not possible to give a psychological analysis of our knowledge of this series, because such an analysis is an analysis of the essential conscious processes through which the object in question becomes itself present to us. The number series *never* becomes present to us. We only have whatever knowledge we do have of it as a whole through symbolic, not intuitive or authentic, representations. These symbolic devices are the *logical sources* of arithmetic (p. 179). Husserl's failure to explain how such devices work in providing knowledge, and thus to attain a *logic* of arithmetic and of mathematics generally, is what drove him to the decade-long research resulting in the *Logical Investigations*, bringing to culmination the early period of his career. In its most immediate form his failure stemmed from his prejudgement that the working mathematician must be engaged in *representing* numbers – albeit symbolically or inauthentically. Husserl came to his task prepared to account for mathematics in terms of the non-intuitive or inauthentic presentations discussed by Brentano (*Husserliana* XII, pp. 190f., 193n.), but then he was forced to come to terms with the fact that the mathematician rarely thinks of numbers at all, but is normally engaged with the workings of an algorithm with no present regard for how it might be interpreted. "The method of sense-perceptible symbols is, thus, *the* logical method of arithmetic" (*Husserliana*, XXI, p. 257). The theory of mathematical consciousness therefore can only be in vanishingly small part a theory of presentations of numbers – even though when appropriate it quite infallibly provides us with knowledge of number relations. How can the purely formal consciousness of the mathematician result in knowledge of number relations? How do the two sides, subjective consciousness and objective reality, come together in cases of this type, as they most surely do?

To answer these questions Husserl returns to ontology, to the theory of whole, part, and relation, in the all-important 1984 paper, "Psychological Studies in the Elements of Logic" (*Husserliana* XXII, pp. 92–123). The whole to be examined is the total state of the individual consciousness, with its 'parts' and the range of their possible modifications. This paper is the germ from which the *Logical Investigations* grew, through the third and sixth Investigations. The task was to work out a general theory of how the contents of consciousness achieve cognitive transcendence, grasping what is not a part of them (and yet somehow enters into them) as it is in itself (*Logical Investigations*, Eng. trans., London, 1970, p. 253f.). Within consciousness – and hence already under what was much later introduced (in *Ideas* I) as the 'bracket' of the phenomenological reduction – Husserl discovered necessary connections between the dependent moments (the sensory as well as the 'act' moments) of intentional experiences. By 1897 he realized that he had discovered within consciousness laws relating to objects

in complete generality (*Husserliana* XXII, p. 133n.), with no dependence upon their specific qualitative natures or on our consciousness thereof. Thus, in structures common to consciousness and to all being as well, a foundational transcendence was achieved which grew into the 'phenomenological breakthrough' (*Logical Investigations*, p. 237).

But Husserl also discovered within consciousness the synthetic progression, that of 'fulfilment', through which one moves from a 'mere' thought toward, and possibly up to, a direct presentation of the relevant object itself, precisely as it was thought. The result, in the ideal case, is a whole comprising a complex, synthetic act of consciousness and the relevant object as it is in itself (*Logical Investigations*, p. 701). Again, transcendence of consciousness is achieved. The accomplishments of Husserl's foundational period were not the result of chanting the magical word 'intentionality' over problems of cognitive consciousness, but came from the painstaking elaboration of a powerful formal ontology within which every aspect of consciousness and of its possible objective correlates could be coherently viewed.

Husserl became famous in the early 20th century, not for his careful philosophical labours generally, but for a grand *tour de force*: the refutation of the psychologistic interpretation of standard laws of formal logic, such as *modus ponens* or the Barbara syllogism. Such laws had come to be conceived of in influential quarters as laws of real mental events taking place in the human mind, laws which could be known only by empirical analysis of such events and would not be true if such events did not exist (*Logical Investigations*, Prolegomena, Chapters IV and V). In a brilliant and many-sided attack, Husserl demonstrated the absurdities of this position – which, contrary to a popular reading of his thought, he himself never came close to holding. The ontological distinction between the real and the ideal was the key to his analysis. The kind of evidence present for the laws of formal logic is incompatible with their being empirical laws of real events (*Logical Investigations*, pp. 157, 192–3). The unity of theory, how the parts of a theory hang together, is a primary theme of formal logic; and *that* unity simply cannot be understood in terms of real events, mental or otherwise (*Logical Investigations*, pp. 42, 236–40). Instead, it involves unities of ideal entities, universals – specifically, of concepts and propositions, the species instantiated by certain intentional moments of real and possible acts of thought. The truths of formal logic refer to the most general features and interrelations of concepts and propositions, which they have without any regard to events of actual thinking; but they also extend in the appropriate fashion to actual thought (*Logical Investigations*, pp. 181, 191–2), precisely in virtue of the concepts and propositions which the latter instantiate. Thus, the laws of formal logic *apply* to actual thought and discourse, but do not *depend* upon them for their truth or for their evidence. Psychologism was disarmed, and – since the ideal laws of cognitive universals go far beyond the merely formal – theorizing about language and thought in general was rendered safe from the ravages of dogmatic empiricism.

Unfortunately, however, Husserl's philosophical views were not well understood, even by many of those who were glad to accept his refutation of psychologism – which, after all, was basically a side issue for him, and accordingly occurs in a 'Prolegomena' to logical studies, not in those studies themselves. He has, as a result, been repeatedly accused of refuting psychologism in Volume I of the *Logical Investigations* and then relapsing into it in Volume II, merely because he deals in the latter with the essential structures of language and consciousness generally.

Husserl's power as a philosopher, and the foundation of all other contributions he has made, lay in his ontological insights: his understanding of the whole/part and other categorical structures which apply to every entity whatever. These insights were in fact worked out within what he later called the *epoché* (ἐποχή). This is because such structures were discovered and studied by him full blown and fully given *within* the acts of consciousness upon which he was led to concentrate by his natural course of thought, given his starting-point. But it was only his

ontological insights, in application to the stream of conscious acts and relevant objects, that made clear to him the possibility of the ἐποχή; and this, surely, is why his first major exposition of the ἐποχή, in *Ideas* I, is prefaced by two lengthy chapters (usually ignored) on general ontology and on associated issues in the theory of knowledge. The ἐποχή, generally regarded as the most quintessentially Husserlian doctrine, is simply unintelligible if it is taken as a starting-point, which explains why it has been so often misread as an exercise in scepticism or in Cartesian doubt.

Husserl's first philosophical work was a categorial investigation, and his first period culminates, at the end of the sixth Logical Investigation, with an essay on categorial intuition. It was the investigation of categorial structures, involving intuition as appropriate, that he was with full self-consciousness engaged in from his earliest work on the concept and essence of number – though many vital elaborations of detail remained to be worked out.

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Husserl, Edmund II: The Later Husserl

To understand the nature of *transcendental phenomenology*, which is the core of Edmund Husserl's late philosophy (from 1913 on), means to clarify what distinguishes his *Logical Investigations* from his *Ideas for a Pure Phenomenology and a Phenomenological Philosophy* (1913), where the transcendental perspective is introduced. This distinction lies in a reformulation of the concept of intentionality. In his *Logical Investigations* (see "Husserl I"), Husserl had distinguished meaning as species (i.e. the function which permits consciousness to grasp its goal), from the object, which is independent of our experience of it. Husserl's *Ideas* I, on the other hand, is characterized by a cognitive approach which understands objects as being essentially related to our experience. According to *Ideas* I, every intentional act has an object of reference (i.e. the object as it is experienced), and Husserl calls the object so conceived the *noema* (νόημα), a Greek word which means 'what is known' or 'what is experienced'. Certainly, what we know or intend at any given time about some object *A* does not exhaust *A*. Hence, *noemata* (νοήματα) are not objects themselves. But the latter are not something essentially different: the object *A* is what Husserl calls *an ideally open synthesis of noemata*; it is – in other words – the outcome towards which every possible increase in knowledge about *A* leads. Therefore the Kantian 'thing in itself' does not exist. According to *Ideas* I, objects are not absolute realities independent of our experience; their existence can be expressed, rather, in terms of the conditions under which we are able to posit them as existing: "An object in itself is never such that it would make no difference to consciousness and the conscious I" (*Ideas* I, Hua III, p. 101). For Husserl, every object is a *unity of meaning* constituted in experience as something real or unreal, inside or outside the ego, etc.: this is the transcendental thesis of Husserl's phenomenological *idealism*.

Hence, the importance of the concept of *phenomenological constitution*: to clarify the essential features of *A* means to describe the experience in which *A* 'takes shape' for us. Now, according to the *Ideas*, there are different categories of objects: things can be material, animal, mental, cultural, etc. As Husserl says, there are different *regional ontologies* to which the different categories of objects belong. For every regional ontology there is a set of apodictic propositions which state "what must hold *a priori* and 'synthet-

ically' of an individual object of the region in question" (*Ideas* I, p. 37). These are propositions such as 'every material thing is *res extensa*', 'every animal body has sensations', 'people can enter into social relationships', etc. Phenomenological constitutive analysis has to solve problems such as what is a material (animal, cultural, etc.) thing as such? What kind of *synthetic* (or *material*) *a priori* propositions can be asserted in order to describe its essential features? Phenomenological constitutive analyses are also at work in the case of *formal ontology*, which is not a regional ontology (a) because it relates not to the objects of any particular material category, but to every possible object, and (b) because its propositions are of an analytical nature. The structures of formal logic and formal ontology are not, for Husserl, the results of arbitrary convention or linguistic stipulation. On the other hand, Husserl believes that the formal sciences cannot be based on metaphysical hypotheses about the nature of objects either. What an object is, according to Husserl, and what its formal properties are can be determined only by experience, which has also to account for the basic logical distinctions. Hence, the idea of a *genealogy of logic*: starting from the lowest level of perceptive experience, Husserl describes the process of constitution of logical categories and their being embedded in the theory of judgement. In the analyses devoted to grounding logic on experience, Husserl tackles the problem of the *conditions* on which the possibility of experiencing objects depends. There is, first of all, a *formal condition*: the single and instantaneous phases of our experience must be linked together by the consciousness of time. But there is also a *material condition*: there are, for Husserl, *bonds of association*, determined by the *nature of the experienced objects* and linking them according to *a priori* laws. Therefore, Husserl does not start from the 'table of judgement', as Kant does, in order to deduce the categories which give form to experience. His analyses go in the opposite direction: in his view, experience is not simply a collection of random data but has itself a definite structure, a necessary form on which it is possible to ground logic.

Husserl's philosophical efforts were not limited to the constitution of the different categories of objects. Starting with his *Ideas*, Husserl felt the need for a philosophical analysis of the world. In our everyday life we are certain of many things: that there is a world, that we live in this world with other persons whom we understand, and so on. Philosophers must pay attention to such 'truths', not because common-sense truisms are of philosophical value as such, but because they are in need of a phenomenological foundation. These themes are discussed in a new light in *The Crisis of European Sciences* (1936). Here he describes the phenomenological structures of the 'life-world', which is constituted as a correlate of *intersubjective experience* and on which, according to Husserl, sciences are based. Basing sciences on the 'life-world' implies, in his view, the rejection both of a positivistic idea of rationality and of the naïve realism which he maintains has prevented modern philosophy from grasping the real concept of subjectivity. Hence the increasing importance, in Husserl's later work, of the distinction between phenomenology and descriptive psychology. If every object and every possible event must be constituted in our experience, experience cannot be regarded from a phenomenological point of view as a psychological event, as a real fact among others. Hence it is necessary, in Husserl's view, to understand phenomenology as *the science of the pure ego*, that is, as a description of experience concerned only with its constituting function, and not with its being a real psychological event in an animal body.

The distinction between the descriptive *psychology* of the *Logical Investigations* and late Husserl's *phenomenological philosophy* is highlighted by the *theory of epoché* (ἐποχή) or *phenomenological reduction*. This theory becomes increasingly intricate in Husserl's philosophy, though we may summarize its meaning by stressing the following points:

1. *The epoché reveals and at the same time sets the limits of the domain of phenomenological data.* Phenomenology has an essentially descriptive nature: pheno-

menological reduction must therefore 'put in brackets' what is without interest for the goal of phenomenological description, i.e. all factors which pertain to the real existence of what we experience. It makes no difference from a descriptive point of view if the *A* I perceive as something real does or does not exist.

2. *The epoché is not only an introduction to phenomenological description but it is also the true introduction to philosophy.* To 'put in brackets' the natural attitude toward reality means to reject naïve realism which prevents us from grasping the constitutive activity of the ego. Thanks to phenomenological reduction, phenomenology is able to understand objectivity as *a transcendental correlate of experience.*
3. Phenomenological reduction shows that phenomenology is *first philosophy*, since all reality and existence is the outcome of phenomenological constitution. Therefore the epoché is the first step towards philosophy as an ultimate science.

Thus the later Husserl stood in opposition to the dominant stream of German philosophical culture of the 1920s and 1930s, which sceptically rejected the possibility of a scientific philosophy and no longer believed in philosophical reason as the guide to existence.

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Hylē

The term ὕλη ('matter') was introduced as a philosophical term by Aristotle. Originally it meant 'woods, forest' and later came to mean also 'wood, building material' or simply 'material'. Although the pre-Socratic philosophers were concerned with what Aristotle called material causes, i.e. with the material source of the cosmos and the objects in it, they had no term for matter in general, only for specific kinds of matter such as air, water, and earth.

Aristotle introduced the concept of ὕλη in *Physics* I, as a postulate to solve a problem about change. In order to show, against Parmenides and the Eleatics, that change does not involve something coming to be from nothing, Aristotle refers to substance as a continuing subject for predications. But sensible substances such as individual humans come to be; hence there must be a continuing subject for the appearance of, e.g., humanity. Making use of an analogy between how a statue, for instance, comes to be by its material receiving an appropriate shape, Aristotle calls the continuing subject *matter* (ὕλη), the defining feature *form* (εἶδος or μορφή).

Hence the individual substance comes to be out of form and matter, and since form and matter remain at the end of the process, they can be understood to be not only the genetic sources but also the basic ontological components of sensible substance. Form defines or determines what the thing is, matter provides the physical basis for existence. The notions of matter and form are closely associated in Aristotle's mind with the notions of potentiality and actuality, respectively. Matter has a potential to receive some form, and when it receives that form, it becomes actually what it was before only in potentiality.

For Aristotle ὕλη is a relative notion: for each level of analysis there can be some corresponding ὕλη. There are, moreover, several standard levels of organization in nature, each with its own ὕλη: the living organism has a body as matter; body is composed of non-homogeneous parts (organs, limbs, etc.), which in turn are com-

posed of homogeneous parts (tissue, etc.), which are composed of the four 'elements', earth, air, water, and fire. But the elements are transformed into one another, hence they must have a common matter. This most basic kind of matter is known as prime matter (πρώτη ὕλη) and is associated with the ultimate subject of all predication of *Metaphysics* VII 3. Aristotle does not devote much attention to this notion, and some modern scholars deny that he ever posited prime matter. Prime matter becomes important in medieval philosophy as the basic material out of which God creates the world. At best prime matter could be for Aristotle only a theoretical abstraction, since matter is never actually found without form.

The term 'ὕλη' was adopted by some later philosophical schools, notably the Stoics and Neoplatonists, who reinterpreted it in the light of their own concepts. For the Stoics, matter is the passive and inert principle of body; for the Neoplatonists it is the lowest in a chain of entities emanating from the One, and it is evil in so far as it is deprived of order. The Greek concept of ὕλη is the ancestor of the modern philosophical and scientific concept of matter. But Aristotle's notion of ὕλη remains a correlative of form, while the modern notion of matter involves an independently existing reality with properties of extension and mass.

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Hylomorphism

Aristotle's theory of matter and form arises from his concern with the problem of substantial change. Like the rest of us, Aristotle experienced generation and corruption going on in the world. Things are born and things die. Yet when something ceases to be it does not disappear. Rather from the ceasing to be as one substance, another substance, or many substances, arise. What must be the nature of sensible things, natural substances, such that this process is possible?

When we reflect on our experiences of substantial change, it becomes evident that there is continuity in nature. When something comes to be it is not entirely new. It has come out of something else. Thus, there must be in nature a principle of continuity, an underlying substratum that continues on passing from one substance to another. Looking for a name for this principle, Aristotle chose ὕλη, the term for wood or timber. If nothing else, this expresses the passivity of the principle, for it passes on in nature from one substance to another, from one natural thing to whatever else emerges via the process of substantial change. There is, thus, a certain eternal or unending character to this principle, which is indeterminate in itself but determinable in successive substances.

The principle, prime or unformed matter, is regarded as being purely potential, for it represents a capacity to be formed in different ways by the different essences it receives through the substantial forms which inform it; a new substantial form which is actualized by the efficient cause of the change comes to be not in prime matter as such, but in the secondary matter, the already formed matter of the preceding substance. This secondary matter, the *materia quantitate signata* of medieval philosophy, is thus individualized by the accidental forms, the quantity, and qualities of the previous substance. In this sense, matter is spoken of as the principle of individuation.

What exist are natural things: substances such as trees, dogs, and humans. These are definite kinds of things; they have an intelligibility which we grasp when we experience them and understand what they are. The fact that these things are examples of certain kinds or species needs an explanation. Form or μορφή was posited by Aristotle as the determining principle, as that which makes a substance to be a certain kind of substance. It confers an essence or nature on passive

matter, thereby actualizing the latter as a substance and at the same time making this substance to be a certain kind of thing.

This union of a potential principle and an actualizing principle gives us a composite, a hylomorphic substance, a substantial unity of these two coprinciples which achieve their being through being together.

In the world of natural substances we note that some are alive; others are not. To apply the hylomorphic theory to living things, it is fitting to call the principles by new names; the substantial form of a living substance is called its *soul*; the matter of the living substance is its *body*. Thus a living natural substance is a composite of body and soul wherein the actualizing principle or soul confers on the potential principle or body the act of living, of being alive, of existing, as well as conferring whatever nature it confers – for example, human nature.

Aristotle's hylomorphic theory was developed across the centuries by his Greek disciples, the Arabian commentators, and especially by the Christian theologians – such scholastic thinkers as Thomas Aquinas. Thus, incorporated into the Catholic intellectual tradition, it came to be the basis of philosophic anthropology in most Catholic universities after the scholastic revival at the beginning of the 20th century. Already the nominalism associated with William Ockham had begun to undermine the idea of substantial forms as conferring essences or natures on things, and the theory fared badly in reflection of the repudiation of Aristotle's physics brought about through the development of modern science in the 17th century.

Still, there is much to recommend the theory. We note that there are many species or kinds of things; and within a species many individual members, for example many human beings within the human race. What makes possible their individuation?

Aristotle's theory posits quantified matter as the principle of individuation in the sense that the same substantial form can be received into many different quantities of matter – many different bodies in the case of mankind – the different accidental qualities of each individual body giving rise to the variety of individual members of the human race.

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I

Iamblichus

Iamblichus, Neoplatonist, born *c.* 245 in Chalcis in Coele Syria (the modern Qinnesrin), died *c.* 326 in Apamea or Daphne near Antioch. Only part of Iamblichus's philosophical output has survived intact; we possess a manifesto of pagan faith and theurgical practice (*On the Mysteries of the Egyptians*, a reply to Porphyry now considered as genuine); four (or five) volumes of a ten-volume sequence on Pythagorean philosophy (*The Life of Pythagoras, Exhortation to Philosophy, On the General Theory of Mathematics, On Nicomachus' Introduction to Arithmetic*, and *Theological Speculations on Arithmetic* – authorship not certain; much of this material has only doxographical value). Of his other works, including a treatise *On the Soul* and several commentaries on Plato and Aristotle, only fragments survive (see Dalsgaard Larsen 1972, Dillon 1973, pp. 18–25).

Iamblichus's contribution to Neoplatonism as regards both philosophical methodology (1) and doctrine (2) appears to have been substantial.

1. In his commentaries on Plato and Aristotle, Iamblichus presupposes that each treatise possesses a specific aim or objective, be it ethical, physical, or

metaphysical. Once the objective has been grasped, the exegete is asked to interpret virtually every line of the treatise in the light of that objective. A further methodological aspect of Iamblichus's exegesis which secured him the admiration of his followers is the consistent use of allegory as a means to illuminate the structures of the intelligible world (see Praechter 1973).

2. From Iamblichus the Neoplatonic School received new doctrinal impulses: due to his initiative Neoplatonic ontology comes to be worked out elaborately in a scholastic fashion (Proclus), and the actual practice of philosophy receives a much stronger religious bias. Whereas Plotinus (*c.* 205–70) divided the intelligible realm into the One, the Intellect, and the Soul, Iamblichus, modifying this scheme, introduces (in his lost *Chaldaean Theology*) a second, creative First Principle probably in order to soften the inherent tension between the One's absolute transcendence on the one hand and its function as cause of all subordinate levels of being on the other (see Dillon 1973).

In addition, Iamblichus assumes intermediary ontological subdivisions in both the noetic and psychic realms, which, convoluted as they may be, tend to let the process of emanation of the various levels of being appear less abrupt. The conviction of a complete harmony between philosophy and religious myth and experience is central in Iamblichus, and the framework of his ontology owes much to theological speculation, above all to the notorious *Chaldaean Oracles*. Iamblichus depicts the psychic realm in particular as crowded by numerous classes of gods, angels, demons, and heroes. On presuppositions such as these the spiritual ascent into the world yonder, which every Platonist aspires to, could not be achieved by the philosopher's intellectual virtues alone and without the help of divine guides and mediators. Iamblichus advocated and actively engaged in the practice of *theurgy*, a ritual designed to invoke the presence and help of gods by means of magic spells and symbols (see Dodds 1947). This prominent religious trait in Iamblichus's philosophy may explain, perhaps, why modern critics have sometimes charged Iamblichus, the Syrian, with subjecting Greek philosophy to the oriental syncretism of his time.

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Idea

It was Plato who gave the first definition of the term 'idea' and the characteristics he listed have remained identical throughout the subsequent history of the word. 'Idea' signifies:

1. the essential form (εἶδος) of a thing;
2. which exists separately from the thing;
3. which, as an exemplary model of the thing, determines the thing's being;
4. and which is in itself the object and absolute terminal point of the act of the intellect.

Thus Platonic ideas constitute a world of essences which are intelligible *per se* existing separately from perceptible bodies, and con-

sidered as impersonally divine. Each positive and natural thing participates in its corresponding idea, wherefrom a reason is given for the thing's being. Furthermore, each idea participates in all the other ideas according to an order that Plato begins to describe in the *Sophist*. This dialogue defines the ideal relations between notions (λόγοι). The human intellect's participation in this system of relations constitutes philosophical knowledge as such, so that by means of its participation in ideas according to their ideal relations the soul possesses *de iure*, if not *de facto*, all possible knowledge whatsoever. Plato's doctrine is very difficult to understand if one wishes to avoid being misled by the magnificent images that express it. It is rendered yet more difficult by Plato's adding a fifth characteristic to ideas:

5. that of being entities which are intellectually apprehended *per se* in intrinsic denomination, i.e. the *esse* of an idea is identical with its *intelligi*. Plato expresses this by saying that an idea is "νοητόν καθ' αὐτό". (Ideas are thus contrasted with extramental things, whose *intelligi* is distinct from their *esse*. The *intelligi* of such things is not one of their real accidents, but an external accident of reason; it is a *denominatio extrinseca* of the *esse* these things have *per se*.)

Medieval Developments. It is not surprising, then, that occidental metaphysics, from Augustine onwards, should endeavour to conceive of ideas as divine archetypes presiding over the intelligent creation of things by God. This new definition enables medieval thinkers to reconcile Plato's five characteristics. In their view, divine ideas are eminently the essential forms of created beings, their separately existing paradigms; they are intelligible (and actually known intellectually) *per se* in intrinsic denomination.

But medieval authors give fundamentally different interpretations of ideas thus conceived. For Thomas Aquinas, ideas are identical with God's very essence, which is intellectually known *per se* in its perfection as that in which all creatures can participate infinitely (God is the thought of thought). For John Duns Scotus, ideas are produced as objective and absolute, yet secondary, terminal points of God's act of intellection, from which, however, they are formally distinct. In this view, ideas are in God the creatures themselves considered as intellectually known *per se* in intrinsic denomination. But they are not created as real things. They merely have the status of objects (*esse obiecti*) of God's intellect; they have an objective being (*esse obiectivum*), by which they are representatively present to God's intellect, and which secures their function of exemplary rules for God's creation of real things.

William Ockham (who will be followed by René Descartes on this point), fearing that this doctrine unduly restricts God's freedom, denies the existence of any ideas in God, and defines ideas as the possible creatures themselves considered as intellectually known by God in extrinsic denomination. On this point the relation between God's ideas and his intellect is much the same as that between any really existing extramental thing and the human intellect; for, the *intelligi* of such a thing by the human intellect is a *denominatio extrinseca* of the thing. But the consequence of Ockham's position is that it becomes impossible for him (as for Descartes) to account for the character of intelligence and love inherent in God's act of creation. This act becomes arbitrary, stemming from a freedom of complete indifference. In reaction to this, Nicolas Malebranche, and more especially Leibniz, will return to theories of divine ideas, renewing to some extent the position of Scotus on this point.

Modern Philosophy. The notion of idea has been remarkably extended throughout the current of thought which originated in Scotism and which developed in the mainstream of modern philosophy up to phenomenology and contemporary analytical philosophy. The foremost theme at issue here is Plato's fourth characteristic: an idea is a mental object which is the absolute terminal point of the act of the intellect. This characteristic can be shown to be fundamental to Scotus's conception of divine ideas. It can also be shown to be of capital importance in his

theory of the intelligible *species* or concept. For Scotus, the intellect does not apprehend the real form of a thing known intellectually in itself; the intellect apprehends this form only *qua* mental object (*esse obiectivum*) which the intellect has representatively formed to itself. Thus, the intellect apprehends a 'representation' of its object; to be precise, the intellect apprehends the object represented in intrinsic denomination in the subjective representation it has abstractively formed for itself. According to Scotus, just as God intellectually apprehends a created being by its idea, without it being necessary that the created being really exist, so too, man intellectually apprehends a real thing by a 'representation', even if this thing does not really exist, or at least, even if this thing does not formally cause the act of intellectual apprehension. For this reason the 'representation' is called an idea and presents itself to the intellect as its absolute primary object, in a way that can be seen at work throughout the whole of modern philosophy. Nevertheless, ideas still retain their third characteristic, that of being exemplary models. For, in the Scotist tradition from Gregory of Rimini to Descartes, that which is true is that which is said to be in reality such as it is signified in idea. Hence, ideas become the criterion of truth, and the relation of adequate correspondence in truth is inverted: this relation is no longer a conformity of the intellect to the thing, but a conformity of the thing, which is said to exist, to its mode of being signified by an idea. It is just such a conception of truth that will be developed by Hegel, after Kant's transcendental use of ideas as supreme regulative principles of objective knowledge.

The Ideal-Objectivity of Meanings in Contemporary Philosophy. These points have met with renewed interest in Edmund Husserl's phenomenology, and in analytic philosophy beginning with Gottlob Frege. Both seek to show how, in subjective acts of linguistic expression, a simple or complex sense (*Sinn* or *Gedanke*) is appealed to as a necessary intermediary between the act of representation (*Vorstellung*) and the thing itself (*Ding*, *Sache*). This sense is reidentifiable *ad infinitum* by conscious subjects who can re-express it in a plurality of possible acts. Thus it enjoys a sort of ideal objectivity, which is identical in every act of the conscious subject.

With Frege, as with François de Mayronnes (who died some time after 1328) and Bernard Bolzano, senses have a positive being, and cannot be constituted in any way by a conscious subject. Rather, the sense belongs to a *drittes Reich* which is distinct from the realm of subjective acts and from the realm of things. The *Sinn* or *Gedanke* is thus separate and autonomous, just as Plato's ideas were in their own order; (cf. characteristic 2). Moreover, it appears that it is intellectually apprehended, or at least signified *per se* in intrinsic denomination, i.e. it is true in itself; (cf. characteristic 5). In no case, however, can it be said to have real existence (*Dasein, Existenz*).

Contrary to this position, Husserl's phenomenology focuses on the subjective transcendental formation of the meanings of language, and makes the presence of an ideal-objective νόημα or *Sinn* appear in every subjective act of consciousness (νόησις) wherein this νόημα is constituted. The νόησις, now, tends *ad infinitum* to make the νόημα coincide with the reality of the thing. Both thereby (particularly in the case of perception) can also be called an idea, in as much as consciousness ideally anticipates the way ideas are to be fully brought to evidence, truth, and reason (*Vernunft*). Ludwig Wittgenstein, in contrast, will refuse, after Brentano, the absolute and separate ideal-objectivity of the *Gedanke* by showing how it arises and is formed through language games.

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Idealism/Realism

Philosophical positions are now usually regarded as idealist if they regard mind or minds (or consciousness) as the fundamental reality and other apparently different sorts of reality, in particular the physical, as either ideal, in the sense of existing only in so far as an actual or potential object of mind's awareness, or as in some sense themselves mental. Also counted as idealist are views which make such a claim about physical reality, even if they admit the possibility that there are realities (e.g. unknowable things behind the scenes) which are neither mental nor ideal. A typically realist metaphysic will claim, with regard to certain realities which idealists have regarded as either ideal or mental, that they are neither and can exist quite apart from any consciousness. Since the status of the physical world is the main bone of contention between the two this article will concentrate on that.

A typical idealist will affirm at least one of the following propositions:

1. Nothing, and above all not physical reality, can exist except as an object (actual or potential) of mind's awareness, apart perhaps from mind itself.
2. Physical reality cannot exist except as an object (actual or potential) of mind's awareness, though other things (besides mind itself) may do so, such as non-physical things in themselves which produce the appearance of a physical world to us (perhaps also abstract objects).
3. Nothing exists which is not mental either in the sense of being either itself a mind or a mode of mind, consciousness, or sentient experience, or in the sense of being what can only exist as an object of mind's awareness.

Mind, in each case, may be understood either as something essentially single, so that different finite minds are aspects of one cosmic mind, or as standing for a plurality of distinct minds, such as yours and mine, with or without a divine mind as well. More radical forms of idealism drop the 'or potential' in the first two propositions, thereby maintaining a more clear-cut position, if one more puzzling for common sense than the weaker forms which require it. The common thread between almost all idealisms is the claim that the idea of physical things existing apart from all experience is incoherent.

George Berkeley (1685–1735) developed his idealism in opposition to the representative realism of John Locke (1632–1704). For Locke (as Berkeley understood him) what we are directly aware of in perception are ideas or images which give a more or less adequate representation of a physical world which we cannot directly experience. This physical world possesses only the primary qualities (shape, movement, etc.) and not the secondary qualities (colour, sound, etc.). Berkeley thought Locke's view of physical reality absurd, since thus understood it is something we can have no ground to believe in. More important still, we cannot even conceive it, since primary qualities without secondary qualities are an absurdity. Since he agreed with Locke that the direct objects of perception are simply ideas, he concluded that by a physical thing we can only mean a certain pattern of ideas such as cannot exist apart from awareness of them. That the physical world evidently outruns the ideas of it present to finite minds shows that it consists not just in these but in the system of ideas present to an infinite mind, God, who continually feeds us with ideas corresponding to a pathway through his own system of ideas. The particular pathway he selects for each of us is prompted by our own acts of will in response to whatever ideas he initially vouchsafed us.

Some commentators think Berkeley's line of thought reasonable if it is once granted that all we actually perceive are ideas, but say that this starting-point was taken over uncritically from Locke *et al*. However, the most forceful parts of Berkeley's reasonings do not presuppose or even require this doctrine. His genius lay in being the first to exhibit how great are the difficulties in shaking off from our conception of a physical thing features which it can only wear for our perception (and which are evidently tied up with the mode of our awareness of it) while retaining

a viable conception of anything which could have concrete existence. Such features consist primarily in its aesthetic and perspectival qualities. Among living supporters of something akin to Berkeleyan idealism the Oxford philosopher John Foster should be mentioned.

Kant (1724–1804) insisted on, and exaggerated, the radical difference between his transcendental idealism and Berkeley's theory. The main real differences are three. First, Kant dwelt less on the subjective nature of the sensible qualities and more on broad categorial characters, such as spatiality, temporality, and above all causal intelligibility. Second, Kant argued that our *a priori* knowledge of these characteristics shows that we do not so much find them in the sensorily given as put them there by the only styles of thinking we can manage. Third, Kant held that the phenomenal physical world, the ideal nature of which he had supposedly demonstrated, was not, as with Berkeley, something produced in us by a divine mind but the way in which a system of unknown things in themselves appears to us, while we ourselves as we know ourselves are only the way further unknowable things in themselves appear to themselves. Recognition that the nature of reality as it is in itself is hidden from us opens the possibility that it is more spiritually significant than it seems, a possibility on which we have a right to rest our moral and religious ideals. It is this unknowability of things in themselves which sets Kant most apart from Berkeley, as also from many later idealists. The Scottish idealist, James Frederick Ferrier (1808–64), was closer to Berkeley on this point but drew conclusions from it on a more Kantian nature.

Kantian idealism was given a novel twist by Arthur Schopenhauer (1788–1860), who agreed that the physical world is merely phenomenal, the way things in themselves appear to us. However, he held that metaphysical reflection reveals that each of us knows his own will as that of which his body is the phenomenal appearance, and inferred from this that will is the ultimate 'in itself' of the whole of nature. Moreover, since plurality can only belong to spatial phenomena the 'in itself' behind nature must be a single will rather than the many it seems to be.

The major idealist nearest to Kant himself was Johann Gottlieb Fichte (1762–1814) who (however) dropped the idea of the thing in itself and postulated a single transcendental ego which produced the panorama of the world for its own spiritual development, thus moving towards that absolute idealism for which all finite things are appearances to or of a single infinite mind. Hegel (1770–1831), who may be called the father of absolute idealism (with his one-time associate F. W. J. Schelling (1775–1854), as its uncle), was not undeniably committed to any of the theses here taken as definitive of idealism. The physical world is certainly for him in some sense an appearance of spirit to itself by means of which it develops in human life to a stage of full self-consciousness, but 'appearance' here may mean rather emanation than something which only exists for a subject. More traditionally idealist in outlook are the absolutists F. H. Bradley (1846–1924) and Josiah Royce (1855–1916). Bradley gives both Berkeleyan and Kantian reasons for the incoherence of a physical world supposed to exist apart from experience of it. His main contribution is to see the relational thinking typical of physical descriptions as incapable of showing how things really hang together, concluding that they must belong together in a much more intensively unitary way which must be spiritual rather than physical. Bradley showed some sympathy for panpsychist forms of idealism which see the physical side of daily life and science as the appearance of a reality which is in itself a flow of lived experience, a position supported by Josiah Royce, Charles Hartshorne, and quite recently by Timothy Sprigge and akin to the views of Alfred North Whitehead (1861–1947), who aimed to synthesize realism and idealism. Other forms of idealism include the final transcendental idealist position of Edmund Husserl (1859–1938) and a personal idealism, which flourished early in this century, for which reality is a community of eternal spirits each of whose less intimate companions appear to it as the physical world.

Realists about the physical world insist that

it can exist quite apart from awareness of it or from anything psychical. For the naïve realist we are directly confronted with bits of the physical world in perception, while for the representational realist we are directly confronted only by representations of it, which, however, we justifiably and rightly take as bringing us information about that real independent physical world. Realists typically think of the burden of proof as on idealists and regard their position as holding the fort when idealist arguments are supposedly refuted. An important 20th-century realist was G. E. Moore (1873–1958), who hovered between its naïve and representationalist versions.

Two types of realism were strongly canvassed in the USA early in this century. The new realism, inspired by a one-sided reading of William James's (1842–1910) radical empiricism, claimed that we directly confront the physical world in perception and that variations in the way things seem to different people show not their subjectivity but their inclusion of a multitude of features from which we select differently. Samuel Alexander (1859–1938), in Britain, took a similar line. The impressive critical realist school, including George Santayana (1863–1952), C. A. Strong (1862–1940), and R. W. Sellars (1912–1989), tended to echo Thomist views in holding that the essence of the thing perceived is directly present to the mind though the thing itself remains quite external to consciousness. In more recent English language philosophy, realism is often associated with a materialism whose reductive approach to mind allows it to bypass the traditional question how the sensuously given relates to the physically real.

Some faint analogy exists between the traditional contrast between realism and idealism and that of realism and anti-realism as currently specified by Michael Dummett (born 1925). The anti-realist about a class of objects thinks that the principle of bivalence (that a proposition must either be true or false) does not apply to statements about them. Many idealists are realists, in this sense, about the physical. However, some of Kant's arguments for his transcendental idealism do turn on an alleged failure of bivalence in propositions about the physical.

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TIMOTHY L. S. SPRIGGE

Identity

There are two ontological problems of identity. The first is present in the question: 'Where x and y are contemporaneous and individual, under what conditions is x one and the same as y?' The second is present in the question 'Where x and y are non-contemporaneous and individual, under what conditions is x one and the same as y?' These ontological questions are distinct from their parallel epistemological questions about what kind of evidence one must have in order to *know* that x and y are one and the same thing, or linguistic questions about when two referring expressions have the same referent. Some philosophers hold that the ontological conditions may be fulfilled even when the epistemological conditions are not; conversely, when epistemological conditions have been made into ontological conditions (usually by philosophers committed to some form of verificationism), the resulting conception of identity often rules out clear cases of identity. An answer to the first ontological question results in a general theory of identity; an answer to the second results in a theory of identity through change or over time.

There is some conflict in Aristotle's writings about how he answers the ontological questions: x and y are one and the same thing for Aristotle if they are the same substance. Since substances are enduring for Aristotle, he can offer the same answer to both questions, for example, Socrates is the teacher of Plato because Socrates and the teacher of

Plato are one and the same substance and the old philosopher who drank hemlock is one and the same with the young philosopher who stood during a performance of *The Clouds* because they are one and the same substance. The problem for Aristotle is the nature of that enduring substance. If secondary matter (the flesh and bones of Socrates) is suggested, it is unclear how secondary matter can ground the identity of Socrates from being a young man to being an old man since that matter changes in his life. In the *Metaphysics* (1031a15–1032a10), Aristotle suggests that each individual may have an individual essence, and it is that essence which grounds the numerical sameness of x and y. Thus, the condition under which x and y are one and the same, whether or not they are contemporaries, is that x and y have one and the same individual essence. The Thomistic tradition in the Middle Ages keeps alive the Aristotelian answers to the two questions. John Duns Scotus, however, is highly critical of matter as a ground for identity; he cannot accept changeable matter as capable of grounding identity through time and he argues that the use of individual essence as a ground only leads to a reformulation of the question, namely, 'When x and y are individual essences under what conditions is x one and the same with y?' Instead, Scotus seeks to ground the individuality of each thing in a special entity which he called its *haecceitas* or 'thisness', which could thus serve as ground for identity without itself needing a ground (*Opus Oxoniense* II. d. 3, q. 6, n. 11, XII, 134a–135a). William Ockham maintains that it is a confusion to ask what 'makes' a material thing an individual; the question, he thinks, is what is it for some concepts, extramaterial entities, to be universal (*Ordinatio* I. d. 2, q. 6.).

The modern period develops in a radically new direction from earlier traditions. Both John Locke and G. W. Leibniz try to give the condition for identity in terms of the properties which individuals have. Thus, Locke's general notion of identity is in *Essay Concerning Human Understanding* (Book II, 27) that x and y are one and the same spirit or body when and only when x and y begin to exist at the same time in the same place.

Leibniz seems to hold to two principles:

1. the *identity of indiscernibles*, namely that if x has every property of y and conversely, then x is one and the same as y; and
2. the *indiscernibility of identicals*, namely, that if x and y are one and the same then every property of x is a property of y and conversely.

Leibniz clearly excludes intentional properties from the set of properties that grounds identity. Together these principles yield a conception of identity which is sometimes crudely stated as: x is one and the same thing as y when and only when everything that is true of x is true of y and conversely. What makes this conception attractive is that since individual things are known through their properties and not through their individual essences or secondary matter, knowledge of identity seems more accessible under the Leibnizian definition. Bertrand Russell embraces Leibniz's conception and the Russell–Leibniz conception of identity is the major theory of identity in the 20th century. However, there are two serious problems for such a theory. The first is pointed out by Max Black, who argues that even if it is true for the actual world that no two things are perfectly alike, there are possible worlds in which there are perfectly indiscernible individuals (1954, pp. 80–92). If Black is right, then the Russell–Leibniz conception cannot be at the core of identity because the identity of indiscernibles is not a necessary truth. The second problem is raised by Hans Reichenbach; he argues that, since nothing prevents two things from having all their non-relational properties in common, the only properties of individual things which can ground individuality are spatial, temporal, or other relational properties (1958, pp. 58–70). Among these relational properties only those that are irreflexive or asymmetrical can determine identity. But an irreflexive relation is one that always holds between one thing and another and an asymmetrical relation is one which is such that, if it holds between one thing and another, then it does not hold between the other and the one. Thus, it looks

as if identity of individuals is grounded in relations with certain properties which in turn have these properties precisely because of the identity or non-identity of individuals. The account is ontologically circular.

Contemporary philosophers still pursue some of the traditional ontological concerns. For example, Gustav Bergmann argues that there are 'bare particulars' which ground the identity of individual things. These particulars, like the *haecceitas* of John Duns Scotus, have no properties, serve as the ground for all individuals of which they are part, and enter into a relation of exemplification with respect to properties such as redness, roundness, or relations like to the left of. Other contemporary philosophers, such as Peter Strawson, take up Ockham's position and simply treat individuality as something that is presented. Strawson's view abandons the traditional ontological questions; it asserts that there is no need to further ground the identity of individual things. Other contemporary writers have looked into special problems of identity such as the problem of personal identity. Their attempts have themselves largely reduced to earlier efforts; for example, to ground personal identity in memory is to ground identity in properties of the individual.

The unsuccessful struggle to formulate the conditions of identity, especially in the face of the fact that conceptions of identity have either been circular or simply posited individuals whose identity need not be grounded, suggests that ontology might do well to follow Strawson and abandon the search for an entity which serves as a ground for individuality and identity in favour of simply accepting numerical sameness and difference as *sui generis* and not subject to reduction.

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KENNETH C. CLATTERBAUGH

Immortality

The religious belief in immortality preceded the attempt to demonstrate it philosophically. The teaching that there is a life after this life, that some part of our being survives our death is as old as Western civilization, and the discussion of proofs for personal immortality has been one of the classical topics of traditional philosophy.

Interestingly, the Nicene Creed affirms a basic belief in 'the resurrection of the body'. However, the teaching on personal immortality as a dogma was not defined until the early 16th century, when the controversy over the proof of immortality was reaching its zenith in the face of the difficulties the Latin Averroists were raising for the Christian Aristotelianism of later scholasticism. Thus the philosophical dialogue concerning immortality developed against a background of religious belief in it.

Plato's *Phaedo* is an attempt to present arguments for the cycle of reincarnation proposed for the Orphic religion. Moreover, it supports the teaching of a life beyond the grave by analysing the implications of intellectual knowledge. To account for our grasp of certain abstract ideas, Socrates argues we must pre-exist this life and have been familiar with these ideas at an earlier stage. And so if we have lived before, it is only consistent that we continue to live afterwards, as daylight follows night.

Augustine was taken with this notion of man as a soul sent to rule the body, a notion which he acquired from the Platonic tradition through Latin translations of Plotinus. This Augustinian theme set the tradition in Western civilization for over a thousand years, and his philosophy of man came to be challenged only in the 13th century when

Latin translations of Aristotle were circulated at Paris. Theologians such as Thomas Aquinas were moved to achieve a new synthesis, this time of Aristotelianism and the Christian faith. One aspect of this integration was Aquinas's adaptation of Aristotle's hylomorphic theory, the theory of man as a composite of body and soul. This theory accounted better for what we experience as our unity, but could it account for the survival of the soul and its operating after death? Against the challenge, now, of Siger of Brabant's (*c.* 1240–84) Averroism, Aquinas argued for the immateriality of the intellectual powers of man and for the principle that the soul, as the source of the act of existing in the composite, ensured the continued existence of the soul as separated.

Later Christian Aristotelians such as John Duns Scotus and William Ockham were less sure of the validity of the demonstration offered by Aquinas and the results of the medieval debates were crystallized in the essay challenging immortality written by Pietro Pomponazzi in the 16th century. In this context personal immortality was declared a Catholic dogma at the fifth Lateran Council of 1513.

As Plato saw, in view of the obvious mortality of humans as embodied, the case for immortality must be built on the premiss that man's mind or intellect is immaterial and is capable of surviving the corruption of the body as a spiritual substance. René Descartes realized this in 1637 when, in the *Discourse on the Method*, he inferred he was a mind, "a substance whose whole essence or nature is to think" and "even if the body were not, the soul would not cease to be what it is". This return to the Augustinian tradition created the so-called mind–body problem of early modern philosophy. How could there be interaction between such disparate substances? Julien Offray de La Mettrie (1709–51) resolved the problem by dropping the mind, and since the 18th century, the identity of the mind with the brain has been the dominant position.

The moral argument for immortality rests on the premiss that ultimate justice must be achieved if the world is intelligible. Since obviously in this life the good often suffer and the wicked succeed, it is inferred there has to be a next life in which justice is done. A version of this argument was favoured by Kant.

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DESMOND J. FITZGERALD

Independence. See: Dependence

Indeterminacy Arguments

An indeterminacy argument is an argument to the effect that an entity or a kind of entity is indeterminate in some important respects. This indeterminacy is relative to some specific conceptions of the entity or kind of entity in question, and the indeterminacy argument declares certain sorts of definiteness or determinateness to be spurious.

Thus we might take meanings of utterance types as a kind of entity. An indeterminacy argument concerning such meanings attacks a conception according to which meanings have the following properties: they are bound up with speakers' or hearers' dispositions to behaviour; they are built up in a certain specific way from the meanings of constituent expressions; they coincide with or differ from the meanings of other utterance types, and so on. The conclusion of the indeterminacy argument declares some of these properties to be spurious as ascribed to entities of the given sort. Other presumed properties of utterance meanings, though, are conceded to be real and to be capable of being instantiated. Whereas, for example, the properties of being connected with dispositions to behaviour are taken to be real properties of utterance meanings, the properties of being built up from constituent meanings in certain

ways or of coinciding with meanings of other utterance types are considered spurious. With regard to these properties, then, utterance meanings can be said to be *indeterminate*.

One extremely common type of indeterminacy argument tries to establish that we cannot determine certain properties of an entity and concludes that the entity is indeterminate. In preparatory steps two things are fixed: various mutually exclusive theses $(T_1, \ldots T_n, \ldots)$ in relation to an entity E, and a finite set of criteria which may be used to evaluate competing claims. It is then assumed that the application of the accepted criteria results in a judgement to the effect that these theses are equally strong. This is stated by the first premiss of the argument:

1. All theses T_i fare equally well in the light of the accepted criteria.

We assume a second and a third premiss:

2. If, as a matter of principle, one cannot decide in favour of a thesis T, then one cannot know that T.
3. If one cannot know about a state of affairs p, then p does not obtain (in the actual world).

From 1. and 2. we get:

4. We cannot know which T_i is true of E.

With 3. we conclude:

5. None of the states of affairs specified by any of the T_i obtains (in the actual world).

Leibniz's argument against absolute space has affinities with indeterminacy arguments having the structure outlined above (*Philosophische Schriften*, ed. by C. I. Gehrhardt, 1875–90, vol. VII). H. Reichenbach employs an indeterminacy argument in his *The Philosophy of Space and Time* (New York, 1958). He argues that the geometry of physical space is indeterminate. In the 20th century, arguments with this structure have been very common in the philosophy of language and the philosophy of mind – they were applied to linguistic meaning, resulting in the thesis of the indeterminacy of translation or meaning (W. V. O. Quine, Ludwig Wittgenstein, Donald Davidson, Saul Kripke). They were applied to linguistic reference, resulting in the thesis of the inscrutability of reference (Quine, Davidson, Hilary Putnam); and they were also used to establish the indeterminacy of psychological states, in particular of belief and desire (especially by Davidson).

The success of an indeterminacy argument depends essentially on two things:

1. on whether the mutually exclusive theses really are equally strong; and
2. on whether the inference from the impossibility of knowledge to non-existence, i.e. whether premiss 3. can be justified.

Often only an arbitrary restriction on evaluation criteria guarantees that the equipollence of the alternative theses can be established. The justification of premiss 3. often appears to succeed only because questionable philosophical premisses are invoked.

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AXEL BÜHLER

Indexicality

Words like 'this', 'I', 'here', and 'now' are called *indexical* expressions, following C. S. Peirce. Such expressions refer to, or 'indicate', something in the context of utterance: 'I' refers to the speaker, 'now' to the time of utterance, 'this' to what the speaker is pointing at, and so on. Their reference thus depends upon their context of use.

An ontology of such *indexical reference* will include an account of several things: speech

acts (performed by speakers of a language), relations of reference (speakers referring to appropriate entities), contexts of speech, and relations of dependence (between reference and context). If the meaning of an expression is distinguished from its referent, then an ontology of meanings will be needed too, plus an account of their role in relations of reference.

Suppose a speaker, pointing at a certain object *O*, says 'This is hot'. Then *O* is the *referent* of 'this' on the given occasion of utterance. Intuitively, the *proposition* expressed by saying 'This is hot' – i.e. what is asserted – depends on the *context* of utterance, on what the speaker is pointing at while saying 'this'; yet the *meaning* of the sentence – specified by the dictionary entries for the words – does not vary with the context. What are these two levels of 'meaning'?

David Kaplan's influential logic of demonstratives distinguishes the *character* and the *content* of a sentence like 'This is hot'. The character is the context-invariant level of meaning, while the content is the proposition expressed, which varies with the object being pointed at. The character is associated with the *rule* governing the use of the sentence, and the content is said to be a *singular proposition* consisting of the individual being pointed at together with the property being attributed to it (drawing partly on Bertrand Russell's talk of propositions in his early logical atomism). What kind of entities are such singular propositions? Is a singular proposition a putative *state of affairs*, and if so what is its existential status – is it a *possible* state of affairs, or is it in itself *indifferent* to being (like a Meinongian objective)? Also, what type of entity is the *context* (or *occasion*) of utterance? Is it a state of affairs, an actual one, viz., that consisting in the speaker's pointing at a certain object while uttering the sentence? Finally, what is the relation of *dependence* that holds between the speaker's referring to the object and her pointing at the object, and between the reference and the context of utterance?

Kaplan does not pursue these ontological issues, as his initial concern was the logic, not the ontology, of demonstrative reference. Thus, he assumes the familiar form of possible-worlds semantics but extends it to demonstratives. Accordingly, singular propositions are assumed to be functions from possible worlds to truth-values, so the content of the sentence 'This is hot' as uttered in a given context (or on a given occasion) is the *function* that assigns *truth* to every *possible world* in which the referent of 'this' in that *context* exists and is hot. And the character of the sentence is the function that assigns to any appropriate *context* of utterance the *proposition* that would be expressed in that context. A context is an *ordered tuple* including relevant entities; for 'This is hot', the context includes the speaker and the object being pointed at. A full ontology for this semantics would need to account for such entities as possible worlds, functions, truth-values, and ordered tuples – as well as individuals, speech acts, relations, and dependence.

Kaplan's notion of character and content was to replace Gottlob Frege's notion of sense. But Frege's own ontology of sense was very different. For Frege, the sense of a sentence is a *thought*, which Frege assumed is an abstract entity, i.e., non-spatial and non-temporal. But thoughts are not functions, much less functions from truth-values to possible worlds. Frege recognized truth-values as entities, without saying what they are, but he recognized neither possible worlds nor, apparently, states of affairs. In particular, Fregean thoughts are not states of affairs; for their constituents are always other senses, not physical objects or the 'concepts' (property-like entities) under which they fall. Further, thoughts are actual (even if abstract) entities, so they cannot be possible states of affairs. In any event, since thoughts are eternal, for Frege, it is difficult to see what might be the thought expressed by saying 'This is hot' in a particular context. Frege's doctrine of sense does not seem to permit the two levels of meaning required for indexical expressions.

Edmund Husserl, however, explicitly distinguished two levels of meaning for indexicals and offered a complex ontology that might serve the needs observed so far. For Husserl, the meaning of an expression is an abstract entity: it is the *species* of the experience expressed by the speech act. For an indexical, or 'essentially occasional', expres-

sion, Husserl distinguished two levels of meaning: one that does not vary with the occasion of use, and one that does. The invariant meaning of 'this' reflects its general semantic function of referring (in normal usage) to what one is seeing and pointing at: this meaning is the general form of perceiving an object, toward which one is pointing in saying 'this'. The occasional meaning, on the other hand, incorporates the speaker's presentation of the particular object visually before him. For the sentence 'This is hot', the invariant meaning is the general form of seeing an object and judging that it is hot, while the occasional meaning is the thought or proposition that a certain object, that which one is seeing, is hot. And the sentence as uttered on a given occasion refers to the state of affairs consisting in the object one sees being hot. The occasion of utterance might be taken to be a complex state of affairs, or complex of states of affairs, consisting in the speaker's uttering the sentence while that object is before him. Not only did Husserl have an ontology of speech acts, reference relations, meanings, and states of affairs, but he had a basic ontology of dependence relations that help him to individuate 'singular' thoughts like the occasional meaning of a given utterance of 'This is hot'. These are precisely the ontological structures needed for a full ontology of indexical reference – whether or not Husserl's own ontology was adequate thereto.

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DAVID WOODRUFF SMITH

Individuality, Individuation

Individuality is the property that characterizes individuals in so far as they are individual; individuation is the process whereby something becomes individual. There are six fundamental philosophical issues involved in individuality. They have to do with:

1. the intension of the term 'individual',
2. its extension,
3. the ontological status of individuality in the individual and its relation to the individual's nature,
4. the principle of individuation,
5. the discernibility of individuals, and
6. the linguistic means of reference to individuals.

The first of these issues is logical, since it is concerned with the intension of the term 'individual' and its distinction from other notions; it involves defining and conceptually clarifying the notion of an individual. Issues 2., 3., and 4. are metaphysical. They concern the description of reality – how far individuality extends and its status and foundation in things. Issue 5. is epistemological, for it has to do with criteria for the discernibility of individuals. Finally, issue 6. is semantic, since it deals with the linguistic means by which we refer to individuals. All these issues have been discussed in the history of philosophy, but very few authors have kept them separate and still fewer have addressed more than one or two. The favourite issue in the Middle Ages concerned the *principle* of individuation; in our own day it is the issues of discernibility and reference that have attracted most attention. The most pertinent issues for us here are the extension of 'individual', the ontological status of individuality, and the problem of individuation. I shall also discuss the problems of intension and discernibility because of their close ties to the others, but I shall not deal with the issue of reference.

The Intension of 'Individual'. Of all the issues mentioned, perhaps the most fundamental but least discussed concerns the definition of individuality. What are the necessary and sufficient conditions for something

to be individual? Throughout the history of Western philosophy individuality has been understood in a variety of ways. At least six stand out: indivisibility, distinction, division, identity, impredicability, and non-instantiability. Most popular, perhaps, is indivisibility; the individual is conceived as what cannot be divided. There are at least three important versions of this view. The first holds an absolute notion of indivisibility: a thing is individual if and only if it cannot be divided. The second maintains that individuals are indivisible in the sense that, if they are divided, they lose their being or nature. The third holds that individuality consists in indivisibility into entities of the same specific nature as the original. Examples of the first and second views are found in the early Middle Ages; the last view prevailed among late Scholastics such as Francisco Suárez.

Another feature that has traditionally been used in the analysis of individuality, particularly in the modern period, has been what might be called 'distinction' or 'difference'. For those who favour this position, a thing is individual in so far as it is distinct or different from other things. In the early medieval period this view was standard; more recently it has been supported by A. J. Ayer, Max Black, and P. F. Strawson.

A third feature frequently associated with individuality is that individuals divide, or, as Scholastics preferred to say, 'multiply' the species, creating what they called 'a plurality'. In this sense a thing is individual if and only if it is actually or potentially part of a group of things all of which belong to a specific class. Among authors who appear to favour this view are William Ockham, Bertrand Russell, and Wilfrid Sellars.

A fourth feature is that of identity, though some authors, like Elizabeth Anscombe, have explicitly argued against the running together of the two notions. By identity here is meant the capacity of individuals to remain the same through time and changes.

Another feature frequently associated with individuals is impredicability. Individuals, it is said, cannot be predicated of other things, while universals can. But impredicability may be understood in two ways, metaphysically and logically, giving rise to two different views of individuality. The first is defended by those who identify individuals with substances, the second by those who approach individuality linguistically. Among proponents of the latter are Strawson, again, and Renford Bambrough.

Finally, I have recently proposed the conception of individuality as non-instantiability. In this way individuality is understood as the incapacity of individuals to become instantiated in the way universals can be.

The Extension of 'Individual'. What is involved here is the determination of whether there are any things that are individual, and if there are any, which are those things. This issue is closely related to the problem of universals (the problem of whether there are any things that are universal and, if there are any, which are universal and which are not). Indeed, for those philosophers who maintain, as most do, that the notions of universality and individuality are exhaustive and mutually exclusive, the problem involved in the extension of 'individual' and the problem of universals are one and the same: to determine the extension of 'individual' would be to determine the extension of 'universal' and vice versa. It is perhaps for this reason, given the overwhelming concern that philosophers have had with universals ever since Plato, that this issue has generally been discussed in the context of universals rather than individuality.

The variety of opinions present in the history of Western philosophy concerning this problem is staggering. But there have been three fundamental views that have divided the philosophical community, even if within those three general views many variations are to be found. One, inspired by Plato, holds that nothing that exists is individual and, therefore, that everything that exists is universal. A second view, inspired by Aristotle, maintains that everything that exists is individual and, therefore, that there are no such things as universals. A third position, most favoured today, finds a place in existence for both individuals and universals; it usually identifies individuals with Aristotelian primary substances and universals with the characteristics of those substances. Traditionally, the first view has been

regarded as a very strong form of realism, the second view has been given the name of nominalism, and the third view has been regarded as a moderate form of realism.

The Ontological Status of Individuality. A third issue, discussed primarily in the Middle Ages, concerns the ontological status of individuality. It involves two questions. The first asks for an ontological characterization of individuality, i.e., for the identification of the ontological type to which individuality belongs. The second question asks for the kind of distinction that there is between individuality on the one hand and the nature of the individual on the other. Obviously, the answer to the latter question depends to a great extent on the answer to the former.

Of the answers that have been given to the first question, five are most important. Individuality has been characterized at various times as a substratum (Gustav Bergmann), a simple or complex feature (Boethius, Russell, Ayer), a relation (Héctor-Neri Castañeda), a mode (Jorge J. E. Gracia), and as nothing but the individual itself (William Ockham).

The answers to the second question also show some variety. Fundamentally, they can be grouped into three basic positions. The first holds that individuality is really distinct from the nature of the individual, so that one can distinguish in an individual two realities, the nature and individuality, which come together to constitute the individual. This is the kind of view attributed sometimes to realists like Duns Scotus. The second view holds that between the individuality of the individual and its nature there is a conceptual distinction only. In reality the individuality of the individual and its nature are one and the same, although conceptually they can be separated. This view is often attributed to nominalists like William Ockham. Third, there is a position that tries to bridge the gap between these two. It uses diverse terminology. John Duns Scotus introduced the term 'formal distinction' and Suárez and others used terms such as 'modal distinction' and 'distinction *ex natura rei*'. In general all these terms aim to convey the point that the distinction between a nature and the individuality of an individual is something less than real but more than conceptual.

The Principle of Individuation. Historically, the most important metaphysical issue related to individuality involves the identification of the principle of individuation. However, different conceptions of individuality will yield a search for different principles. For it is one thing to ask, for example, for a principle of indivisibility and another to ask for a principle of difference and distinction. Different extensional and ontological views of individuality will likewise affect the answer given to our present question.

1. Individuation of Substances. The different types of theories that have been proposed concerning the individuation of *substances* may be classified as follows: bundle theories; theories of accidental, essential, and existential individuation; mixed theories; and theories based on external principles.

Although there are different varieties of bundle theories of individuation, most agree that the principle of individuation is the bundle of all the characteristics that an individual has. Thus Socrates is individual because he has a unique bundle or cluster of characteristics that separates him from all other beings. There have been defenders of this sort of view in every period of the history of philosophy from Boethius to Leibniz and Russell.

In contrast with the bundle theory, the theory of accidental individuation holds that it is only certain accidents that are responsible for the individuality of things. There are various versions of this view, depending on the accidental characteristics identified as individuators, but the most commonly found are relational theories that identify spatial, temporal, or spatio-temporal location as individuators. The spatio-temporal theory originated with Boethius and became standard in the early Middle Ages, but has subsequently been held by John Locke and Strawson.

Others, in contrast, choose characteristics *essential* to a thing as individuators. Again there are different varieties of this view. Three in particular stand out. The first, frequently attributed to Aristotle and recently defended by Anscombe, argues that it is the matter that individuates. A second, attributed to Averroes by Scholastics and

more recently defended by Jan Łukasiewicz and David Wiggins, posits the form of a thing as its individuator. The third holds that individuation is due to a *sui generis* principle whose function is only to individuate and which has no characteristics of its own. It is for this reason – namely, that it is decharacterized – that the principle in question has been called by Bergmann and his followers a 'bare particular'. In the Middle Ages, Scotus and his disciples referred to it as thisness (*haecceitas*).

Much less popular than these theories is the theory of existential individuation. This view, which in the Middle Ages was generally attributed to Avicenna and may have also been defended by William of Auvergne and Locke, has recently been adopted by Gracia. According to this position, the principle of individuation is existence.

Some views mix essential and accidental characteristics. For example, Thomas Aquinas identified the principle of individuation with matter under dimensions. The dimensions in question were understood to be indeterminate in the early part of his career, but determinate later on.

Finally, there have been authors like Roger Bacon who have found the source of individuation in principles external to a thing, for example in the natural or supernatural agents that produced it. But these views have not been frequently defended in the history of philosophy and are very deficient from a theoretical point of view.

2. Individuation of Accidents. The views mentioned above are the most important with respect to the individuation of substances, and most other views can be reduced to one of them. Now, those who, like most late Scholastics and like G. F. Stout and certain others in our own century, hold that not only Aristotelian primary substances but also the properties and accidents of substances, too, are subject to individuation, have devised three basic types of theories to account for this individuation. The first maintains that properties and accidents are individuated through the substance in which they are found. This is the view of Thomas Aquinas, for example. The second holds that the properties and accidents of a substance are individuated through other properties and accidents of that substance; this view has been defended by Boethius, for example. The third, adopted by Suárez and Stout, maintains that properties and accidents are individual through themselves.

Discernibility of Individuals. The issue of the discernibility of individuals is epistemic, although it is frequently confused or purposefully identified with the issue of individuation, as Russell and Strawson do. Individuation involves the identification of the principle that makes something individual. The discernibility of individuals, on the other hand, has to do with the principles that make possible the identification of an individual by a knower: how and by what means are we able to discern individuals *qua* individuals?

Obviously, the two issues are closely related, and this has made possible their frequent confusion in the history of philosophy. But there are authors, such as Suárez, Popper, and Castañeda, who do not confuse them. In contemporary circles many authors believe, however, that the only legitimate issue for philosophers is the epistemic one. With respect to the principles that philosophers have identified as principles of discernibility, we find as many theories as there are of individuation, and they follow along much the same lines. There are bundle theories, and theories based on accidental, essential or even *sui generis* principles.

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JORGE J. E. GRACIA

Inevitability

'Inevitable' may be used to express either

(1) a kind of time-dependent, conditioned natural necessity:

or

(2) a kind of time-independent natural necessity;

or else

(3) a kind of (time-independent) absolute necessity.

With (1) in mind we assert, for instance, that an event (or state of affairs, or action), which was not inevitable e.g. yesterday, has now become inevitable; or that, although it is not inevitable right now, it is just about to become inevitable. The distinction between (1) and (2)–(3) is probably to be traced back to Aristotle: "to say that everything that is, is of necessity, when it is, is not the same as saying unconditionally that it is of necessity" (*De Int.* 19a25–26).

Two interrelated factors are at play in (1). Time: an event e may be inevitable at t, but not have been inevitable at any earlier time; and a set of conditions c (plus the prevailing laws of nature), which need not have obtained at all, but whose obtaining at t deprives e of whatever possibilities it had, before t, of not occurring. More specifically, the obtaining of c at t neutralizes, as of after t, at least those possible ways for e not to occur whose realization would not involve any gratuitous departure from the way in which events of the type exemplified by e are 'normally' or 'naturally' averted. (For example: fulfilment, on your opponent's part, of a sudden and irreversible craving for self-destruction on the chessboard hardly qualifies as a 'normal' or 'natural' way for you to avert mate, whereas an accurate defence on your part so qualifies. Now suppose mate is inevitable at t: c will then neutralize, as of after t, all possible ways of the latter, but not necessarily of the former, type.)

Notice that 'e is inevitable at t' is actually shorthand for 'The occurrence of e at $t + n$ is inevitable at t': e is first inevitable – e.g. at t; then it occurs – e.g. at $t + n$. (The present inevitability of the past is no exception here. A past event first occurred, and *then* it became inevitable: we still have two temporal indices. Not so the present inevitability of the present, which only involves one temporal index – viz. *now*.) In a more familiar language: at all the physically, or causally, possible worlds whose history may or may not coincide with the history of our own world up to t, but wherein c obtains at t, e occurs at $t + n$. Given c at t, that is, there is no physically, or causally, possible way for e not to occur: the proviso, 'if nothing "natural" interferes' makes little or no difference when the inevitable, be it taken in sense (1) or (2) or (3), is being dealt with.

Things take a rather more drastic turn when it comes to (2) and (3) above. There being no question of anything's *becoming* inevitable here, talk of temporally dependent inevitability naturally gives way to talk of inevitability *simpliciter*. With (2) in mind we assert, to take the extreme case, that what will be is already inevitable, and always has been; and that, of what is and was, it always had been inevitable that it would be. (This fairly accurately captures the idea of a wholly deterministic world: whether or not such a world counts as a world at which everything happens by absolute necessity, however, depends on whether or not the laws of nature prevailing therein are themselves absolutely necessary. To say they are is to have (3) in mind: the strongest possible instance of inevitability *simpliciter*.) Talk of a set of conditions c, in turn, gives way to talk of a chain of conditions the obtaining of each of which had always been inevitable: such a chain will of course extend downwards in time to the very first instant of the history of the universe.

Now clearly, taken in sense (1) 'inevitable' expresses no kind of absolute, but rather a kind of conditioned or conditional, necessity. The distinction between conditioned necessity – the schoolmen's necessity *ex suppositione* (or *ex hypothesi*), or necessity *secundum quid*, or *necessitas consequentiae* – and absolute necessity or necessity *simpliciter* or *necessitas consequentis* goes back to Aristotle: very likely at play in the passage quoted at the outset of this article, it is explicitly stated in *Analytica Priora* 30b31–33: "one might show by an exposition of terms that the

conclusion is not necessary without qualifications, though it is necessary given the premisses".

It is essentially meant to show that something's being necessarily the case need not be incompatible with its being *contingently* the case. The idea is this: something may be necessary *only* on the hypothesis that such-and-such conditions obtain, contingently, at such-and-such a time (hence, plainly, the fact that inevitability in sense (1) is a kind of conditioned necessity). Or it may be necessary without any such hypothesis, hence necessary in an *un*conditioned or absolute way (as in the case of propositions which are true purely by virtue of the relations of concepts), hence incompatible with contingency.

For instance: Diodorus is now running; then, *given that* he is, he could not but be moving (now). No (absolute) necessity, however, need attach to Diodorus's moving now, taken in and of itself. What is absolutely necessary here is the entire conditional (or 'consequence': *necessitas consequentiae*), 'If Diodorus is running, then he is moving', not the consequent thereof – a questionable way of saying that the latter is 'merely' necessary *secundum quid* or *ex suppositione*. But let both the 'consequence' and the antecedent be necessary: then, the schoolmen maintained, the consequent will be necessary as well, by *necessitas consequentis*. (This is the familiar modal principle, 'If (necessarily (if p, then q)), then (if necessarily p, then necessarily q)'.)

Future contingents. The distinction just briefly described plays a fairly important role in scholastic and contemporary discussions of the problem of 'future contingents' (events whose futurition is a purely contingent matter), the source of which is to be found in Chapter 9 of Aristotle's *De Interpretatione*. There are two aspects of the problem: a theological aspect – this is the question whether or not God's (fore)knowledge of what will happen is compatible with contingency (or with the 'openness' of the future); and a metaphysical-semantical aspect – this is the question whether or not the principle of bivalence as applied to statements about the future (where e is an event which is yet to occur, the principle says that either 'e will occur' is true, or its contradictory is) is compatible with the claim that at least some of those statements are contingently true – that the future, unlike the past, is 'open'. The problem comes about as follows.

For the theological aspect: whatever is known by (an infallible and immutable) God could not fail to be the case. Hence, in particular, if God has already come to know that a given event e will occur, then, necessarily, e will occur: e's occurrence is not now, and in fact had never been, contingent at all. Put 'necessarily' where it belongs, however (do the same with 'could not fail'), and the argument falls flat: as Boethius (see *Philosophiae Consolatio*, V, 6), Thomas Aquinas (see *De Veritate*, q. 2, a. 12), and Leibniz (see *Théodicée*, §37), among others, have pointed out, all that is (absolutely) necessary here is the entire conditional, (*C*) 'If God has already come to know that e will occur then e will occur'. From (*C*)'s being (absolutely) necessary it follows in no way, of course, that its consequent is itself absolutely necessary: at most, that it is necessary *secundum quid*. God's foreknowledge, then, since it need not be taken to bestow on events anything more than a necessity *secundum quid*, or to involve anything more than a *necessitas consequentiae*, both of which are modally harmless, could hardly be regarded as a threat to contingency.

Things are not so easily handled, however, when the way out we have just considered is coupled with the view that what has (by) now been the case cannot (now) not have been the case. (The past is necessary: *ad praeteritum non est potentia*, in the schoolmen's rendering of Aristotle's *De Caelo* 283b12–14. That is: there are no present possibilities which concern the past; as for past possibilities, they could have been, but cannot *now* be, realized in the past.)

The argument, as reported by Aquinas (*Sum. Theol.* I, q. 14, a. 13), goes like this: the antecedent of (*C*) is necessary, since it is about the past; but (*C*) too, we have seen, is necessary; hence, given the modal principle cited earlier, the consequent of (*C*) will also be necessary. Hence, either God's foreknowledge is incompatible with contingency,

and there are no future contingents at all; or else future contingents (if such there be) cannot be foreknown by God.

The argument is evidently quite powerful: it relies on the obvious necessity of conditionals such as (*C*), which, by setting up a seemingly unbreakable connection between the past and the future, make it possible to derive the necessity of the future from that of the past. Break the connection, then, and you have disposed of the argument. Like this: grant that (*C*) is necessary, that its antecedent and consequent are necessary, but deny that the former is about the past and the latter about the future. Or like this: deny both that the antecedent of (*C*) is necessary, *and* that it is about the past. I shall return to the second option (Ockham's) later. According to the first option, Aquinas's (see *Sum. Theol.* I, q. 14 a. 13, ad 3), the antecedent and the consequent of (*C*) are about the present: God knows all things – past, present, and future – outside time, in an eternal present (the view is Boethius's). He knows each of them, in particular, as a fact present to him *ab aeterno*, hence, thus known, as necessary: for the present is necessary, the schoolmen (with the exception of John Duns Scotus, see *Lectura* I, d. 39, q. u., n. 50–60) maintained after Aristotle – *Omne quod est, quando est, necesse est esse*. The notion of *fore*knowledge, and the idea of setting up a (necessary) link between the past and the future make, evidently, little or no sense here: what remains is the necessity of the present, which in no way affects the modal status of the future.

Let us now turn to the metaphysical-semantical aspect of the problem of future contingents: the necessity of the future has traditionally been defended by appealing to the following argument (the non-theological original of the argument I have discussed in the last two paragraphs: it, too, goes back to Chapter 9 of Aristotle's *De Int.*). To begin with, replace 'true' with 'already true' in the version of the principle of bivalence given above: the replacement is readily justified – for, just as, of what is now the case, it was earlier true that it would now be the case, so, of what will be the case, it is *already* true that it will be the case. But the truth of e.g. '"*e* will occur" is already true' entails that of '"*e* will occur" was true' (if already true, then, plainly, true at some time earlier than the present). We are dealing, then with a truth about the *past*; hence, with something (now) necessary, since every truth about the past is (now) necessary. Further, the conditional, 'If "*e* will occur" is already true, then *e* will occur', is necessary: but so is its antecedent; so, therefore, is its consequent. The moral is easily drawn: what will be, will be of necessity.

This is the argument: how can it be met? Two lines of defence naturally suggest themselves. The first, which has been adopted by e.g. Aristotle, Peter Aureoli. Peter de Rivo (1420–1500), and A. N. Prior, consists in claiming that neither version of the principle of bivalence applies to (singular) statements about the future: such statements only acquire a truth-value when the appropriate state of affairs obtains – or fails to obtain. Equivalently, it consists in rejecting the principle that, of what will be, it has been the case that it will be. (It is not clear, though, exactly what is being claimed and rejected here. The crucial phrases, '. . . is already true' and '. . . it has been the case that . . .', certainly do not wear their meaning, if any, on their sleeves.) Either way, the argument is disarmed by breaking the link it sets up betwen the past and the future: no such link, clearly, no argument.

The other line of defence, Ockham's (see *Quodlibeta Septem*, IV, q.4; *Tractatus de praedestinatione*, q.1 M,N), consists in drawing the following distinction. On the one hand are statements whose truth is contingent upon something's being the case which is not yet, and may never be, the case (for instance, past-tense statements with a future-tense subordinate clause: such statements are said by Ockham to be 'verbally' about the past, but 'really' about the future). On the other are statements whose truth depends entirely on the way things already have been (for instance, statements wherein no reference is made to a time later than the present). Unlike statements of the second kind, statements of the first kind are only contingently true: at least if the future-tense subordinate clause they contain is itself contingently true.

Let it not be objected that a statement about the past is, if true, now unpreventably

(or else necessarily) true: for e.g. '"*e* will occur" was true' is not at all a statement about the past. Its truth is a function of what is yet to be, hence not unpreventable, hence contingent, and the step from 'true' to 'now unpreventably (or else necessarily) true' only holds for statements which are both verbally *and* really ('*secundum vocem et secundum rem*', in Ockham's phrase) about the past. (This is not to deny, of course, that the past is necessary.) The two arguments discussed earlier are, thereby, disposed of.

We are left with two rather intriguing questions. First, can the distinction between past-tense statements about the past and past-tense statements *not* about the past be drawn in a semantically satisfactory way? Second, according to the line of defence I have been discussing, the truth-value of '"*e* will occur" was true' depends on that of '*e* will occur'. How is this dependence to be understood? (Perhaps in terms of counterfactual dependence: if *e* were not to occur/were to occur, '"*e* will occur" was true' would have been false/true. Although a view of this sort does not quite imply that the past can be *changed*, it certainly suggests that we have power over something past–viz. the past truth of some statements about the future.)

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FABRIZIO MONDADORI

Infinity

Which came first, the chicken or the egg? On the basis of such familiar empirical generalizations as that every chicken comes from a chicken egg and every chicken egg from a chicken, even fairly young children can be brought to recoil laughingly from the logical consequence – an infinite sequence of those barnyard episodes reaching back into the past – and one is thus theologically ripe to accept the cosmological argument for the existence of God (as first cause).

Notice that there is a non-standard as well as a standard version of any such regress where the former features the small as opposed to the large infinite. Dividing an hour Zeno-fashion into successive segments each of which is respectively ½, ¼, ⅛ etc. of the whole, the entire sequence consisting of chicken–egg–chicken–egg etc. could be mathematically compressed into a single hour, with a last but no first element. Thanks to being thus realizable in terms of either the small or the large infinite, the sequence fails (in the absence of further constraints) to entail the antithesis of Kant's First Antinomy, namely that the world has no beginning in time. Zeno and Kant's Antinomies pretty much sum up between them the traditional albeit paradoxical resources on which any ontology of the infinite is expected to draw.

More recently, a third resource has emerged that is arguably as important as either of the others. This is the mathematical science of set theory whose immediate value lies in the clarification it brings to the paradox-prone concept of infinity, though it must be confessed to generate puzzles of its own of which Bertrand Russell's paradox is only the most notorious. The benefits are real enough, however. Taking the natural numbers as one's paradigm of an infinite set, one is prone to define an infinite set as one whose members can be placed in one-to-one correspondence with the natural numbers. If the rational numbers threaten now to be a counter-example to the definition owing to their sheer density, one is relieved to find that they, too, can be rearranged so as to qualify as an enumerable or denumerable set. Not so, however, when it comes to the irrational numbers, as Georg Cantor demonstrated, thereby refuting the proposed definition on the basis of what can now be seen to be the central insight of set theory. By no means merely confined to conceptual clarification,

set theory projects a rich ontology that comprises a non-denumerable infinity of abstract entities; and even a nominalist, who eschews all such items across the board, may find himself pressured to allow in his ontology a non-denumerable infinity of concrete objects, modelled on Cantor's Theorem. Thus physics standardly takes space and time to have the mathematical structure of the continuum, thereby being committed to non-denumerably many points and instants. If a nominalist like Hartry Field can rest content with these items, others take them to be only marginally less objectionable than sets, preferring to treat them like sets as mere conceptual conveniences; and one may then conjecture that Cantor's Theorem must prove irrelevant when it comes to fully concrete objects. Let the nominalist, however, allow into his ontology quantities of stuff like gold and water, and the theorem comes into play at any rate in a universe consisting of infinitely many Democritean atoms. For corresponding to each set of Democritean atoms there will be a determinate quantity of 'adamant' serving as the mereological sum or 'fusion' of those atoms. The quantities of adamant cannot possibly be supposed to be denumerable (*pace* the Skolemites).

Nominalism aside, scepticism regarding the non-denumerable is associated with the Löwenheim–Skolem Theorem according to which any standard theory that is satisfied in a non-denumerable domain can also be satisfied in a denumerable one, leading at once to Skolem's Paradox. How can a theory featuring Cantor's Theorem be satisfied in a denumerable domain? Refusing to accept Cantor's result at face value, the Skolemites trade on the fact that the irrationals individually constructed one by one within the theory are at once non-denumerable relative to the resources available to the theory and denumerable relative to those outside the system. Although most researchers in the field are satisfied that we have access to a notion of absolute as well as relative non-denumerability, this distinction between intrasystematic and extrasystematic considerations proves a source of embarrassment in its own right. Consider all the sets whose existence can be deduced from the axioms of Zermelo–Fraenkel set theory where those sets are now taken to be absolutely non-denumerable. According to the Zermelo–Fraenkel so-called 'cumulative' conception of a set, there ought now to be an accumulation of all those sets into a new set that can only be recognized, however, from outside the system. Let us then accommodate this new set in an enriched version of Zermelo–Fraenkel, adding the so-called Axiom of the Inaccessible Cardinal to the system. The problem returns, however, and a second such axiom will be required, and a third etc. Any axiomatization of the Zermelo–Fraenkel conception of a set – widely regarded as providing the definitive solution to Russell's paradox – will thus fall short of expressing that conception at full strength, thereby raising doubts as to how we might be entitled to credit ourselves with any such non-axiomatizable conception.

What to do? The most radical solution is to take the difficulty as but one further bit of confirmation of Kant's position. Transcending all possible experience, statements involving the infinite are to be ruled out as cognitively spurious. When we credit ourselves with grasping the meaning of the sentence, 'The world has no beginning in time' or even 'The total number of stars (past, present and future) is odd', we are labouring under a semantic illusion, according to Michael Dummett. How precisely Dummett proposes to block a deduction of the former sentence from our barnyard generalizations (which are probably acceptable enough, thanks to being at any rate empirically falsifiable) *plus* some proviso that rules out the small infinite here, one may not find easy to determine even after consulting the non-standard, intuitionistic logic that guides his verificationist anti-realism. In a more purely mathematical vein the Intuitionists, notably L. E. J. Brouwer (1881–1966) convict us of a logical illusion when we insist that either 7777 occurs somewhere in the (potentially infinite) decimal expansion of π or the sequence is everywhere absent from it.

A Quinean solution to our difficulty might appeal to W. V. O. Quine's recent insistence that no sets need be endorsed by us beyond those required for physics. Truncating the

Zermelo–Fraenkel universe, the Quinean can thus reject the Axiom of the Inaccessible Cardinal from the outset. Even so, Paul J. Cohen's proof in 1963 that the Continuum Hypothesis is undecidable in standard set theory remains as a source of disquietude to those who fear that our very concept of a set (and *a fortiori* of an infinite set) is thereby shown to be fatally underdetermined. One has only to follow linguists like D. T. Langendoen and P. M. Postal, however, in their refusal to restrict English sentences to those of finite length. Sentences of any arbitrary transfinite length being allowed by them, a proof or disproof of the Continuum Hypothesis may be presumed to be available.

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JOSÉ A. BENARDETE

Information

The notion of information is extremely versatile. It may mean a measure of physical organization (or decrease in entropy), a pattern of communication between sources and receivers, a form of control and feedback, the probability of a message being transmitted over a communication channel, the content of a cognitive state, the meaning of a linguistic form, or the reduction of some uncertainty. These senses of information are defined in appropriate theories such as physics, communication theory, cybernetics, statistical information theory, psychology, semantics, inductive logic, and so on. There is no unique notion of information upon which the above senses converge and hence no proprietary theory of information. Yet these different senses do share a basic intuition about some facts of the world that make information possible. One such fact is that of organized causation: causal interactions in the world occur among structures; as a result, structures cause in virtue of their organization, and are caused to be organized in some way or another. The other fact is that the first fact can be exploited, at some level of complexity, to obtain and utilize particular effects. Let us unpack this shared intuition.

Information is instantiated whenever states of the world interact causally in virtue of their organization. If a system of states is construed as source (S) and another as receiver (R), we can say that whenever S causally interacts with R, a state of S produces in R a state whose structure reflects (given R's design) the impact of the interaction with S. As a result of such an interaction, R's state causes other internal as well as behavioural states whose organizations reflect the impact of earlier interactions. What we have in this compact characterization are three basic conditions on information, one structural, another interactional, and a third behavioural. This is to say that structures are formed, and react or behave or have effects, in virtue of their causal interaction with other structures. A closer look at how these conditions are met at various levels of ontological complexity reveals several forms of information.

Material Information. If the systems involved in an interaction are simple aggregations of elementary particles, atoms, molecules, and the like, subject to physical laws, then the information relations they exemplify can be said to be of the material sort. A state of a physical body reflects in its structure the gravitational and often the mechanical impact of its interactions with other physical bodies, and as a result causes the body to occupy some further states with appropriate structures. Likewise, the molecular organization of a liquid reflects the impact of the surrounding heat, and causes the liquid to behave in certain ways. Given that our world is made of elementary particles, atoms, and molecules, material information is every-

where. The key constraint on material information relations is nomological: the information relations in the world instantiate lawful correlations among physical properties (Dretske 1981).

Functional Information. If the world were just physical, in the sense that its structures, interactions, and laws were as physics portrays them to be, then the information in the world would be exclusively material, and the notion of information would need no further analysis. But the world also contains more complex systems whose internal structures and causal interactions reflect functional constraints not mirrored by physical laws. Biological and cognitive systems are of the functional sort. The information relations they instantiate are no longer merely material. Suppose that a system *R* is organized in such a way that, upon a causal interaction with a source *S*, it instantiates a sequence of structures which produces specific behaviours. Although the causal interactions and the instantiations of structures in *R* are compatible with the laws of physics, their internal sequencing and behavioural effects cannot be explained from any set of such laws. *R* is a functional system of the sort exemplified by living beings or machines. Such systems handle not only material but also functional information. The latter is instantiated in a system whenever the organization of its structures produces types of causal effects whose sequencing and co-operation can only be understood as the execution of certain functions (i.e. the production of certain outcomes) under constraints which reflect a job to be done, some purpose, adaptation requirements, the maintenance of certain parameters (energy conservation, survival), or the like. A cell, an organism, or an engine is a functional information system (Dretske 1986).

Semantic Information. Information is often associated analytically and exclusively with cognition. This is a mistake. Neither material nor functional information relations need have cognitive significance, yet both prepare the ground for cognitive information in its semantic form. The latter obtains whenever material states instantiated by a functional sequence in a system *R*, as a result of an interaction with a distal *S* by way of some proximal input, covary systematically with specific states of *S*. When these conditions of distality, specificity, and systematic covariation are met, we can say that states of *R* encode *semantic* information about states of *S* (Dretske 1981, Fodor 1987, Bogdan 1988).

Cognition is encoding, processing, and utilization of semantic information. The latter is functional information (in a system) which systematically covaries with specific and distal properties in the environment and guides the system's behaviour toward items displaying those specific and distal properties. Visual information is semantic in that it allows us to identify systematically specific and distal objects and events (i.e., within limits, irrespective of angle, distance, illumination, and other such variables) toward which we can behave in certain ways (grasp, eat, push, avoid, and so on). Mere functional information in a cognitive system has only proximal reach, lacks specificity, and does not systematically correlate with the system's behaviour. Cells, for example, have a cognitive machinery (sensor and transduction proteins, a primitive memory, and so on) whose information fails to be semantic because it only has proximal reach (the chemical substances on the surface of the cell) and a very diffuse and non-specific focus (it barely discriminates some values of chemical gradient, and nothing else), yet is functional because it enables the cell to behave in function of what it senses. Likewise, the successive information structures (retinal, neural, etc.) which constitute our visual information are themselves only functional (although the overall product is semantic): the retinal information has proximal reach in that it is caused by and covaries only with the light intensities at the retina; is undifferentiated in that it only discriminates simple physical variations; and does not systematically correlate with our movements and actions.

Pragmatic Information. Biological organisms generally need semantic information to guide their behaviours toward targets of vital interest. To this end, they develop specialized systems (vision, recognition, sensory-motor co-ordination) which handle semantic information relations. Some species (humans, for example) develop *further* specialized sys-

tems (for reasoning, decision, imagining, speech acts, and so on) which *utilize* semantic information for purposes other than recognition of properties and guidance of behaviour, as in simpler organisms. The utilization of information for solving problems, answering questions, making decisions, imagining alternatives, or communicating, obeys constraints and principles which are more than semantic (i.e. representing something distal and specific) because they are sensitive to what is new, surprising, conducive to a solution, relevant, important, or useful to an agent in a context. Furthermore, the information relations utilized in this manner are causally efficacious in virtue of having these pragmatic rather than merely semantic properties. People react not only to what some information is about (its semantic character) but also to how that information affects their beliefs, expectations, plans of action, and the like (its pragmatic character). We have therefore a new form of information, the *pragmatic* form, which is instantiated and operative in those semantic information systems whose external interactions and internal structures are exploited and utilized by central cognitive capabilities (thinking, problem solving, planning, communicating, etc.) for reasons and in ways other than semantic, that is, other than identifying and linking with properties of the world (Bogdan 1986).

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RADU J. BOGDAN

Ingarden, Roman

Roman Witold Ingarden, Polish philosopher (born 5 February 1893, died 14 June 1970), was professor in Lvov (1933–9, habilitation 1924) and in Cracow (1945–63). He was a disciple of Edmund Husserl from 1912, under whom he took his Ph.D. in Freiburg in 1918. Ingarden embraced in particular Husserl's ontological approach to philosophy as set out in the *Logical Investigations*, and his idea of philosophy as a rigorous science. But he sought to refute Husserl's transcendental idealism, starting out from ontological investigations of his own. These are set out in his unfinished main work *The Controversy about the Existence of the World*.

Ontology, in Ingarden's sense, analyses the necessary structures of possible objects: it seeks to establish alternative possible structures of the world, where metaphysics would establish which of these alternatives is in fact realized. Ingarden distinguishes further between *existential ontology*, which investigates the modes of existence of different kinds of objects; *formal ontology*, which investigates the forms of objects (as contrasted with their material or qualitative aspects); and *material ontology*, which deals with these qualitative aspects themselves. The *Controversy* is divided up accordingly: Volume 1 deals with existential ontology, Volumes 2 and 3 with formal ontology.

The *Controversy* contains extensive analyses of the modes of existence especially of temporal objects (events, processes, states), of the forms of individual objects, of ideas, states of affairs, relations, regions of being, worlds, and consciousness. Volume 3 contains an analysis of the causal nexus (cause and effect are regarded as simultaneous), of relatively isolated systems and of the problem of determinism.

The metaphysical (and concomitant epistemological) parts of the work were not written, but Ingarden's analyses of temporal existence (cf. 1983) and his stress on the reality of free human actions realizing values, seem to imply the possibility of a metaphysical investigation of man, and the final considerations of Volume 3 may be held to imply a certain priority of at least some metaphysical investigations to material ontology. Ingarden's last work (English translation 1983) is devoted to the ontological foundations of responsibility.

Ingarden is principally known, however, not for his investigations in general ontology and metaphysics but for his writings in aesthetics, and especially for his classic work on the ontology of literature (1931, English translation 1973). Even this, however, was undertaken in order to establish a radical difference of structure as between 'intentional objects' – objects created by and dependent on acts of consciousness – and objects in reality.

Epistemology, for Ingarden, is divided into 'pure' epistemology – which investigates the ideas or essences of cognitive acts as revealed in "immanent eidetic intuition" and establishes ultimate principles of cognition – and 'applied' epistemology, which is partly empirical, and applies these principles to actual cases. In his epistemology, therefore, Ingarden initially embraces Husserl's notion of pure consciousness as the area where structures of mental acts may be indubitably cognized. Ingarden, however, rejects the necessity of any sort of transcendental reduction in philosophy and his analyses lead to a conception of consciousness not as something independent but as a merely abstract stratum in the real self. Ingarden thereby denies all the ontological features – irreality, self-sufficiency, and separateness – that had been ascribed to consciousness by Husserl. And he thereby undermines, in fact, the very notion of a 'pure' consciousness in the Husserlian mould.

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ANDRZEJ PÓŁTAWSKI

Intension/Extension

Every set of elements or individuals can be associated with a characteristic property, so that an element has this property if and only if it belongs to this set. Thus, we can say that the *intension* of a concept or term is the characteristic property of all individuals and only those individuals to which the concept applies. The *extension* of the concept or term, on the other hand, is this very set itself.

From Aristotle to Mill. The distinction between intension and extension goes back to the Aristotelian tradition. For Aristotle there only *exist*, in the full meaning of the word, *first substances*, i.e. individuals. *Second substances*, i.e. such properties of individuals as *human*, *animal*, etc., can be separately considered, but this is merely the result of a process of abstraction, which allows us to treat as a separate being what has no separate existence. This ontological privilege of first substances is associated with a certain epistemological privilege of the properties abstracted. Terms for the latter are called predicates. When two predicates are joined by the copula, this signifies that the second is contained in the intension of the first. The possibility of inverting this intensional connection into an extensional one (without losing its main properties, especially transitivity) is made obvious by the Porphyrian tree: the transition, e.g., from *substance* to *body*, then to *animal*, to *man*, and ultimately to the individual *Socrates*, illustrates the double motion by which intension increases while extension decreases. Hereafter, as handbooks will say:

> When a term is contained in the extension of another, this other is contained in the intension of the first. Therefore extension and intension are in inverse ratio one to the other (Goblot, *Traité de logique*, Paris: A. Colin, 1918, p. 104).

Many authors in the Aristotelian tradition are led to assimilate the individual itself to a concept having maximal intension and minimal extension. (The latter is then said to be ineffable, because it is impossible to say of it everything which is to be said.) An individual, on this view, is the 'smallest species'. This attitude is enforced, from the 11th century on, when most logicians in addition assimilate each singular sentence to a universal one: thus the individual is held to be comprised in the extension of the con-

cept, just as the property expressed by the concept itself is comprised in the individual's intension.

The distinction between intension and extension becomes completely explicit only in the 17th century. It seems that the authors of the *Logique de Port-Royal* were the first to use in this meaning, on the one hand, the word '*compréhension*', which in French will prevail over 'intension', and, on the other hand, the word 'extension'. Leibniz, somewhat later, used 'intension' and 'extension'; others like J. S. Mill (1806–73) prefer 'connotation' and 'denotation', but his work is still clearly in the wake of the Aristotelian tradition. The distinction was not seriously submitted to revision until the logical reform of the end of the 19th century.

19th-Century Revisions. First the scope of the distinction was extended beyond the monadic predicate, to relational and, more generally, to every form of predicate, whatever the number of its arguments. If a concept (or, in Gottlob Frege's vocabulary, a function) is conveyed by a dyadic predicate, i.e. by a predicate which expresses a relation between two individuals, then there always corresponds, in extension, the class of ordered couples between which the given relation holds. And if the predicate expresses a triadic predicate, then there corresponds as extension the relevant class of ordered triplets, etc. Thus the obsolescence of the Aristotelian predicate provokes a generalization of the intension/extension distinction.

Frege (1848–1925) and Giuseppe Peano (1858–1932) in addition broke with the classical assimilation of the relation of an individual to the set to which it belongs with the relation of a subset to the set in which it is included. Thus it is now the *set of individuals* which constitutes the extension of a concept as distinct from the individuals themselves belonging to this set. An individual can therefore no longer be considered to be that set of minimal extension and maximal (or even infinite) intension, with which some scholastic philosophers had tried to identify it. The radical distinction between *concept* (*Begriff*) and *object* (*Gegenstand*) now makes it necessary to reserve the application of *intension* and *extension* only to the first.

But Frege does not only distinguish object and concept under which it falls. He also, no less radically, distinguishes the concept of first degree under which the object falls from the concept of second degree under which the preceding concept falls, and this distinction is later generalized by the different theories of logical types. The relations based on *intension* and *extension* can retain the property of transitivity traditionally attributed to them, only if the concepts to which they apply are of the same degree or of the same type. If, for example, we allow numbers of different kinds to be regarded as homogeneous, then we can admit that each of the terms

integer, rational, real, number,

is included in the following one, then we can accept the idea of their increasing extension and their correlatively decreasing intension. But this is no longer the case concerning the successive terms

Peter, apostle, twelve, number,

because to consider as transitive the relation between each of these terms would yield a nonsense. This was already perceived by some scholastic authors who nevertheless did not find means to overcome this difficulty.

Under these conditions, we should have no serious reason, as Bertrand Russell acknowledged, to exercise a preference as between the point of view of extension and that of intension. But Frege already spoke in some texts as if he was assimilating what he called *Sinn* (*sense*) with the *intension* of the concept, and what he called *Bedeutung* (*reference*) with its *extension*; and then, by taking into account the individuals themselves, not the manner of their designation, and the truth-values of the sentences, not their senses, it is as though he gives preference to extension over intension. This terminological inflexion received the consecration of the *Principia Mathematica*, where we are told, for example, that:

When two functions are formally equivalent we shall say that they have the same *extension*... Propositions in which a function ϕ occurs may depend for their truth-value, upon the particular function ϕ, or they may depend only upon the extension of ϕ. In the former case, we will call the proposition concerned an *intensional* function of ϕ; in the latter case, an *extensional* function of ϕ (Volume I, p. 187).

Thus the proposition "I believe (x). ϕx" is called intensional, because its truth-value does not depend on the truth-value of "(x). ϕx". 'Extensionality' becomes here synonymous with 'truth-functionality'. Such an assimilation is still more evident in the works of Rudolf Carnap.

Another sense of the notion of *extension* is related to the way in which we define identity in logic or set theory. We can define the identity of two predicates or of two sets of individuals, either by the sameness of the individuals which are arguments of such predicates or elements of such sets, or by the sameness of the predicates of predicates which apply to these predicates or of the sets of sets to which these sets of individuals belong. The first kind of definition is usually qualified as *extensional*, because it is grounded exclusively on the consideration of the individuals, the set of which constitutes the *extension* of the concept.

This explains why the set-theoretical axiom, which allows us to infer, from the mere sameness of the elements of given sets, the identity of the sets of sets to which such sets belong – an axiom which Zermelo had first, in 1918, called the *Axiom der Bestimmtheit* – is today standardly referred to as the *axiom of extensionality*.

Thus, while the development of logic since the end of the 19th century contributed to freeing the distinction intension/extension from some confusions inherited from the Aristotelian tradition, the use made of this distinction by modern logicians and mathematicians cannot always be considered irreproachable.

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JEAN-LOUIS GARDIES

Intensive Magnitudes

Aristotle remarks in *Categories* 10b that some qualities allow for more and less. It was one of the main problems of medieval philosophers to make ontological sense of this idea. Under the terms of intension and remission they discussed gradual difference and change with respect to what they thought to be the same quality, as e.g. warmth. Two interpretations were mainly considered: to assign the gradual difference and increment or decrement either to the quality itself, or to the participation of the subject in the quality. The degree of participation of the subject in the quality was also equated with the degree of existence of the quality, since according to Aristotle to exist, for a quality, is to inhere in a subject. The former view prevailed in the Middle Ages, especially as advocated by John Duns Scotus. He distinguishes formal and individual parts in a quality and interprets intension (remission) as an addition (subtraction) of individual parts. There was a third interpretation reducing intensities to different mixtures of a quality with its opposite. Concerning change of intensity, the Scotist conception of addition, in which every grade contains its predecessor and develops from it, conflicted with a succession conception in which the grades replace each other. Even the advocates of the latter conception stick to the premiss that successive grades are only numerically but not specifically different.

In the modern age the existential view of intensity was most influential. It can be found in Kant, in Alexius Meinong, and, though diluted to a metaphor, even in contemporary philosophy of science. Franz Brentano, in his

Kategorienlehre, criticizes the view pointing out that existence is univocal. He rejects it also because it presupposes a Thomistic composition of things, i.e. composition of essence and existence. His own explanation derives intensity from the amount of unnoticeable gaps in a quality field.

The difficulties of the traditional approach to intensive magnitudes arise from the assumption that differences in intensity go with specific sameness, e.g. that the different degrees of warmth are occurrences of the same quality of warmth. For an adequate ontology of intensity one has to realize that different degrees are different species of the same genus. The succession of intensive magnitudes of the same kind is based on a greater-relation which is asymmetric and transitive.

A traditional problem of intensive magnitudes arises also from a narrow definition of magnitude requiring divisibility which intensive magnitudes seemed to lack. Brentano's conception of intensity is expressly designed to provide intensive magnitudes with parts. It was generally taken for granted that extensive magnitudes consist of parts, of units. In this there was a failure to distinguish between the magnitude and the object which has it. A magnitude such as a length of 12 inches is a property. One can divide a stick which has it into twelve inch-long parts, but not the property itself. Such an operation of division and combination of objects which is used in measurement is called an additive operation. And magnitudes can be divided into extensive and intensive according to whether an additive measurement operation is available for them or not. Today this is no longer considered, as it was still e.g. by N. R. Campbell, to be a distinction between the measurable and the non-measurable. The range of the measurable has been expanded considerably in the intervening years.

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ERWIN TEGTMEIER

Intentionality

Contemporary philosophical discussions of intentionality may be traced to the following famous passage by Franz Brentano in a chapter of his *Psychology from an Empirical Standpoint* of 1874, entitled "The distinction between mental and physical phenomena":

> Psychologists of an earlier period have already directed attention to a particular affinity and analogy which exists among all mental phenomena, while the physical do not share in it. Every mental phenomenon is characterized by what the scholastics of the Middle Ages called the intentional (and also mental) inexistence (*Inexistenz*) of an object (*Gegenstand*), and what we would call, although in not entirely unambiguous terms, the reference to a content, a direction upon an object (by which we are not to understand a reality in this case), or an immanent objectivity. Each one includes something as object within itself, although not always in the same way. In presentation something is presented, in judgement something is affirmed or denied, in love [something is] loved, in hate [something] hated, in desire [something] desired, etc.
>
> This intentional inexistence is exclusively characteristic of mental phenomena. No physical phenomenon manifests anything similar. Consequently, we can define mental phenomena by saying that they are such phenomena as include an object intentionally within themselves.

According to this passage, a mental phenomenon is one that includes an object that is not a 'reality' but exists merely 'immanently' or 'intentionally'. However, in a 1911 paper "Genuine and fictitious objects" (reprinted in Chisholm 1960), Brentano gave up the doctrine that the objects of mental acts have a special kind of existence or being – intentional inexistence:

> And so it holds true generally that nothing other than things (*Dinge*), which fall entirely within the same concept of real entity (*Reales*), can provide an object (*Gegenstand*) for mental reference. Nothing else can ever be, like a real entity, the thing to which we mentally refer as an object.

In this, he agreed with his student Edmund Husserl, who introduced the term 'intentionality':

It is a serious error to draw a real (*reell*) distinction between 'merely immanent' or 'intentional' objects, on the one hand, and 'transcendent', 'actual' objects, which may correspond to them on the other . . . It need only be said to be acknowledged *that the intentional object of a presentation is the same as its actual object, and on occasion as its external object, and that it is absurd to distinguish between them* (*Logical Investigations*, 1900–1).

When purged of the doctrine of intentional inexistence, Brentano's thesis becomes:

1. (a) All mental phenomena make reference to or are directed upon an object.
   (b) Only mental phenomena make reference to or are directed upon an object.

2. No physical phenomenon makes reference to or is directed upon an object.

The term 'intentionality', which derives from the Latin *intendere*, meaning to point, was introduced by Husserl, not for this general property of being directed or making reference, but for a property explicitly restricted to certain *conscious experiences*: "The qualifying adjective 'intentional' names the essence common to the class of experiences we wish to mark off, the peculiarity of *intending*, of referring to what is objective, in a presentative or other analogous fashion." Thus, Husserl ruled out, by definition, non-mental intentional phenomena (according to some philosophers, linguistic phenomena, for example, are intentional but non-mental) and mental phenomena that are intentional but non-conscious (e.g., standing beliefs, long-term ambitions, etc.). Moreover, Husserl did not accept the thesis – entailed by Brentano's thesis – that *all* mental phenomena are intentional: "That not all experiences are intentional is proved by sensations and sensational complexes."

Contemporary philosophers, especially those writing in English, would accept something like the following informal definition: a phenomenon (state, event) is intentional if and only if it is 'directed toward' or 'makes reference to' something. Quotation marks are added to emphasize that the indicated phrases are used metaphorically. Evidently these spatial and linguistic metaphors can be eliminated in favour of a literal use of the term 'about', yielding the following informal definition:

> A phenomenon (state, event) is intentional if and only if it is about something.

Thus, intentionality is the property of aboutness possessed by certain phenomena. In contemporary philosophy Brentano's original theses 1. and 2. have become the following:

I. (a) All mental phenomena are intentional.
   (b) Only mental phenomena are intentional.

II. No purely physical phenomenon is intentional.

Contemporary philosophers, somewhat inaccurately, call I. and II. Brentano's thesis of intentionality. I. is often referred to as (Brentano's thesis of) intentionality-as-the-mark-of-the-mental. II. is referred to as (Brentano's thesis of) the irreducibility-of-the-intentional.

On the contemporary formulation, an intentional phenomenon need not be about an *object* (i.e., an individual particular). For example, the phenomenon of judging that every man is mortal is not about any particular *object*; nevertheless it would be counted as intentional because it is about something, namely, mankind and mortality. Brentano, by contrast, was inclined to restrict the range of the 'directed toward' relation to *objects*. (Accordingly, he would have treated a judgement that every man is mortal as a denial of the conjunction of a man with the attribute mortal. This treatment becomes ever more awkward for more complex examples.) Furthermore, the term 'mental phenomena' is now almost universally understood to apply to not only conscious ('occurrent') mental phenomena but also 'standing' mental phenomena (e.g., standing beliefs), which need not be conscious.

As indicated, Husserl used the term 'intentional' in a more restricted way to pick out an explicitly psychological property, thereby

rendering trivial the proposition expressed by the sentence, "Only mental phenomena are intentional." According to standard contemporary usage, by contrast, intentionality is not an explicitly psychological property; it is simply the general property of aboutness. Consequently, the above sentence expresses a highly non-trivial philosophical thesis – namely, thesis I.b.

By using the term 'intentionality' for the general property of aboutness rather than for an explicitly psychological property, contemporary philosophers have been able to use the term to formulate a closely related substantive philosophical question: are intentional phenomena *fundamentally* linguistic or psychological? This was the main question under debate in the famous Sellars-Chisholm correspondence "Intentionality and the mental" (1958), wherein Sellars adopted the linguistic thesis and Chisholm the psychological thesis. With the advent of H. Paul Grice's intention-based analysis of linguistic meaning, Sellars's linguistic thesis has lost the support of most philosophers writing in English. In contemporary French critical theory, a number of philosophers still find it fashionable to reject the psychological thesis; however, these philosophers evidently have not come to terms with the power and elegance of the Gricean analysis. On this analysis, linguistic meaning is defined in psychological terms (intending, believing, etc.); accordingly, intentional linguistic phenomena turn out, upon analysis, to be complex phenomena concerning co-ordinated psychological states of relevant groups of people. (It should be mentioned that a distant relative of the linguistic thesis survives in the form of J. Fodor's 'language-of-thought' hypothesis in philosophy of mind, namely, the thesis that the ranges of all fundamental psychological relations – belief, desire, etc. – are comprised of sentences belonging to a hypothetical non-public 'language', tokens of which are somehow inscribed in or realized in the brain. However, because this sort of 'language' is not a genuine public language, this position is not a version of the linguistic thesis, which is that public linguistic phenomena are the primary intentional phenomena.)

Assessment of Thesis I.a. A number of contemporary epistemologists and philosophers of science are drawn to thesis I.a in connection with the doctrine of the 'theory-ladenness' of perceptual experience, the doctrine that all perceptual experience is 'interpreted'. However, it is difficult to see how in perceptual experience there could fail to be a further element, namely, the element that is subjected to 'interpretation' – what Husserl calls the ὕλη (matter) of an experience. Arguments in recent philosophy of mind concerning the irreducibility of *qualia* – pure phenomenal qualities – lend support to this view. An attractive moderate position, therefore, is the following: all perceptual experience is intentional although there is always a separately identifiable element in perceptual experience that has no intentionality.

Assessment of Thesis I.b. Linguistic phenomena provide the most likely candidate counterexamples to thesis I.b. For example, the production of a linguistic token 'Out of order' by a vending machine *means* that the machine is out of order and, hence, is *about* the machine even though this does not seem to be a *mental* phenomenon. However, as already indicated, H. Paul Grice's analysis of linguistic meaning has convinced most philosophers that all such linguistic phenomena depend, by definition, on certain co-ordinated psychological states of people in the relevant language group and, hence, must be counted as partly psychological. In the vending machine case, it is the communicative intentions of the manufacturer that give the machine its intentionality.

Thesis II. and the Analysis of Intentionality. Contemporary thought is deeply divided over thesis II. the irreducibility-of-the-intentional. It is ironic, therefore, that most philosophers participating in the contemporary debate have – either implicitly or explicitly – abandoned the prospect of giving a general analysis of intentionality. (For example, Searle 1983 states without any argument: "In my view it is not possible to give a logical analysis of the Intentionality of the mental . . . There is no neutral standpoint from which we can survey the relations between Intentional states and the world and then describe them in non-Intentionalistic

terms. Any explanation of Intentionality, therefore, takes place within the circle of Intentional concepts.") The importance of this issue for thesis II. is seldom realized. Suppose that there does not exist a general analysis (physicalistic or otherwise) specifying what intentional phenomena have in common. Then, intentional phenomena would have a property – namely their intentionality (this general unanalysable property) – that is not a purely physical property. Accordingly, intentional phenomena would not be purely physical. Therefore, thesis II. would be vindicated. (Reductionists who would venture piecemeal analyses of individual types of intentional phenomena – e.g., belief, desire, etc. – might try to assemble them into a disjunctive analysis of the general property of intentionality. However, the acceptability of disjunctive analyses is questionable in general. Moreover, this approach must assume that there is a *finite* list of every *logically possible* type of intentionality. But this assumption seems to be without basis.) The possibility of a general analysis of intentionality is thus a pressing question.

Virtually no philosophers have attempted a general analysis of intentionality. One exception is Fred Dretske (1981), who gives an analysis in probabilistic terms (using the 'information theory' of Hartley, Weaver, Shannon, Wiener, *et al.*). However, there are several counterexamples showing that this analysis provides neither necessary nor sufficient conditions.

Another exception is Roderick Chisholm. In his early work on intentionality (1957), Chisholm offered extremely insightful and influential purely logical criteria for intentional language (i.e., sentences that report intentional phenomena). These criteria were found to be deficient in various ways (see, e.g., Bealer 1982), but they nevertheless constituted promising suggestions. In later years Chisholm abandoned his effort to give purely logical criteria for intentionality. Indeed, he implicitly adopted the 'circle-of-intentional-concepts' posture pursuing a definitional strategy that tries to define certain basic logical notions (e.g., the notion of one property's involving another) in terms of certain intentional notions (e.g., the notion of a person's conceiving something). Within this scheme he then attempts general definitions of intentionality and of the psychological. While not formally circular, this way of proceeding is far less illuminating philosophically, for it uses intentional notions in the very definition of intentionality and the psychological. Moreover, within this scheme the prospect of a satisfactory logical theory is far less likely, given that some ultimate primitives in Chisholm's logical theory would be psychological notions which are resistant to rigorous theoretical treatment.

A Logical Analysis of Intentionality. On the face of it, the term 'about' does not seem to be a psychological term; on the contrary, it seems topic neutral and, if anything, belongs to logic, broadly construed. In view of this, it would not be implausible that an analysis of the notion of an intentional phenomenon could be stated within an appropriate logical theory. Such an analysis was ventured by Bealer (1982 and 1986). A slightly altered version is presented below.

By logic, we understand intensional logic, the sort of logic in which equivalent expressions cannot always be substituted for one another without changing the truth-value of the sentences in which they occur. Intensionality in language results from reference to intensional entities, entities that can be equivalent without being identical. Properties, relations, and propositions are the paradigmatic intensional entities. Among the various properties and relations, certain ones stand out as 'basic' or 'natural' (for example, green and blue) whereas others are derivative (e.g., grue, bleen, being identical to green, being distinct from blue, etc.). These basic or natural properties and relations are called, respectively, qualities and connections. Derivative intensions can be obtained from these distinguished properties and relations (and perhaps subjects of singular predications) by means of fundamental logical operations (conjunction, negation, existential generalization, singular predication, etc.). The intensions that can be so obtained may in that sense be considered complex.

Notice that propositions (and other complex intensions) just on their own, independ-

ently of whether anyone believes (or otherwise employs) them, are said to be *about* things. For example, the proposition that Socrates is wise is about Socrates and wisdom; and this would be so even if no one had ever considered the proposition. The aboutness of complex intensions can evidently be successfully analysed within a suitably rich intensional logic.

Our thesis here is that the aboutness of all intentional phenomena derives from individuals' bearing relevant connections (namely, *intentional connections*) to complex intensions that, just on their own, are about things. We suggest the following definitions.

D1. A connection is *hyperintensional* if and only if it can contingently connect some individual to some complex intension without connecting the individual to some necessarily equivalent complex intension and without the original intension having veracity.

D2. A connection is a *mediating intentional* connection if and only if it is – or is necessarily included in – a hyperintensional connection whose range is necessarily restricted to complex intensions.

D3. A connection is a *mediated intentional* connection if and only if, necessarily, it connects an individual to an item only if some mediating intentional connection connects the individual to a complex intension that is about the item.

D4. A connection is a *direct intentional* connection if and only if it is a hyperintensional connection that is neither mediating nor mediated.

(A complex intension has veracity if it is a true proposition or a complex property or relation that applies to something actual.) Seeming, believing, knowing, and deciding are examples of mediating intentional connections; looking for and seeing objects are examples of mediated intentional connections; acquaintance is an example of a direct intentional connection. (These examples are only heuristic; settling which intentional relations are genuine connections and which intentional connections are mediating, mediated, or direct is ultimately a matter of theory.)

With these definitions in place, we can state a purely logical analysis of the notion of an intentional phenomenon. Intentional phenomena are either basic or derived. A phenomenon p is a basic intentional phenomenon if and only if, for some individual x, some mediating, mediated, or direct intentional connection c, and some item y, p is the phenomenon of x's bearing c to y. Derived intentional phenomena are phenomena whose analysis depends in some essential way on basic intentional phenomena.

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GEORGE BEALER

Intentions. See: Second Intentions

Intuitionism

Intuitionism is a mathematical programme founded by the Dutch mathematician Luitzen Egbertus Jan Brouwer (1881–1966). It emerged from the turn-of-the-century drive to give a set-theoretic analysis of *the continuum* (the set of real numbers, the set of points on the line) and of functions over the continuum. During this period it became clear that mathematics cannot dispense with

infinitistic methods. The continuum, for instance, was shown to be representable as a non-denumerably infinite set whose elements are themselves infinite sequences of rational numbers.

Philosophically, Brouwer espoused an epistemological idealism which claimed that there can be no unexperienced truths, and an ontological idealism which claimed that all objects originate in the activity of a primordial consciousness. Brouwer, like Kant, held that empirical objects are generated by mental acts and that mathematical objects stem from the abstract *a priori* form of such acts. His approach, however, was more solipsistic than that of Kant. Moreover, he rejected the aprioricity of space, and based mathematics entirely on a refined conception of the aprioricity of time.

Number Theory. The simplest mathematical act is that of distinguishing two diverse elements in the flow of consciousness. If we add to this the possibility of repetition and concatenation, we can generate all of the individual natural numbers, the rational numbers, and the standard arithmetical operations. Equations like $358 + 272 = 630$ are, for Brouwer, reports of completed compound constructions.

The Continuum. Unfortunately, the simple, terminating processes involved in such arithmetical constructions cannot produce the infinite sequences which compose the continuum. 'Proto-intuitionists', such as Emile Borel (1871–1956) and Henri Léon Lebesgue (1875–1941), were prepared in some of their writings to admit only those infinite sequences which are generated by finitely graspable rules for calculating their elements. However, the set of all such algorithmic sequences is denumerable, and thus the real numbers based on these sequences can scarcely form a continuum. At first Brouwer tried to circumvent this by postulating a single intuition of an always unfinished non-denumerable continuum. But by 1918 he had replaced this with a brilliant generalization of the notion of algorithm: the concept of a *choice sequence*. A choice sequence of rational numbers is determined by an initial segment of finitely many elements together with a 'rule' for continuing the sequence. The rule, however, may leave room for some degree of freedom in choosing each element. Thus, for instance, the rule might require the n + 1st choice to be some rational number within $1/n$ of the nth choice, but be no more restrictive than that. In this way the sequence (and indeed its corresponding real number) can be said to be only semi-determinate. For any non-trivial interval we can produce a semi-determinate real number falling in that interval. Indeed, the set of all such reals in the interval is demonstrably non-denumerable. Using his theory of choice sequences, Brouwer obtained a series of results that conflict with standard (classical) mathematics. The most famous of these is the theorem that every fully defined function over an interval of real numbers is uniformly continuous. (Pictorially, the graph of the function has no gaps or jumps.) He also revised the traditional notions of set theory to accommodate these sequences and their built-in freedom of growth.

The Creating Subject. The notion of a choice sequence exploits that aspect of the human intuition of time which we may call its 'open future'. This feature is based on the contingency of empirical events, something that is not ordinarily associated with mathematical processes. In the 1940s, Brouwer introduced the method of the *creating subject*. This is a technique for individuating semi-determinate mathematical sequences by focusing on the activity of an idealized mathematician (the creating subject) who is investigating a mathematical proposition, P, which has not yet been either proved or refuted. For example, we may define a real number, r, as a decimal fraction in which the nth decimal place is 1, if by the nth stage of his research the creating subject has proved or refuted P, and is 0 otherwise.

Brouwer used this method to provide direct counterexamples to various classical theorems. Thus, for instance, since there is no guarantee that P will ever be proved or refuted, r violates the classical trichotomy: $(\forall x)\ (x<0 \vee x=0 \vee x>0)$. The fact that Brouwer speaks of a single creating subject is sometimes taken as evidence of his solipsism. But even if one is not a solipsist, the method of the creating subject does generate semi-

determinate objects which are not based on non-mathematical processes.

Ontology. Unlike his disciple Arend Heyting (1898–1989), who viewed intuitionistic and classical mathematics as separate and therefore compatible subjects, Brouwer saw a clash between classical mathematics and intuitionism. He even occasionally claimed that classical mathematics is inconsistent at the points where it differs from intuitionism. This conflict is not a matter of ontology. The intuitionist and classical mathematician agree, for instance, that the continuum consists of reals generated by convergent sequences of rational numbers. Rather, the clash was over what we may call the 'preontology' of mathematics: it pertains to the basic concept of what counts as a mathematical object. Brouwer allows, and classical mathematics rejects, infinite objects which may be incomplete (i.e., temporarily or even permanently indeterminate with respect to some relevant property).

Logic and Language. According to Brouwer, linguistic communication merely simulates basic mathematical constructions, which themselves occur at a prelinguistic level of consciousness. For this reason he rejected the idea that mathematics is restricted by the expressive capacity of any fixed language, and he strongly opposed the view that formal logic is an autonomous science which dictates the limits of mathematical thought. Logic, at best, only codifies some already completed stage of mathematical reasoning. Thus, for instance, classical logic (and in particular the law of the excluded middle) arose from an 'observational period' during which mankind was concerned mainly with cataloguing finite empirical phenomena whose properties are essentially decidable. Classical mathematics insists on applying this logic to infinitary aspects of mathematics where, Brouwer holds, it is inappropriate.

Formalization. Brouwer's views notwithstanding, Heyting produced in 1930 a formal system for intuitionistic logic and some parts of intuitionistic mathematics. This in turn gave rise to further formalizations (even of the theories of choice sequences and of the creating subject) and to a series of semantic and algebraic studies of intuitionistic logic. The study of intuitionistic formal systems has developed into a major branch of mathematical logic. For a while this study used strongly classical methods, but since the 1970s intuitionistic methods have been employed as well. Thus to a certain extent the line between intuitionism and traditional mathematical logic has been blurred.

Meaning and Metaphysics. Heyting himself suggested that his original formalization reflected a theory of meaning implicit in Brouwer's view that there are no unexperienceable truths (indeed a theory underlying some of Brouwer's arguments). This theory replaces the traditional correspondence notion of truth with the notion of constructive provability and provides recursive clauses defining the 'assertability conditions' of compound statements. Thus, for instance, the content of the claim about the r defined above is that the given trichotomy *cannot be asserted* for r. More recently, Michael Dummett has explored the possibility of extending the 'assertabilist' theory of meaning to areas of discourse outside mathematics. He has shown how assertabilism provides a strategy for combating realism about such things as physical objects, mental objects, and the past.

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CARL J. POSY

J

James, William

Philosophers sometimes think of William James (1842–1910) as more psychologist than philosopher. Almost as mistaken are those who see him only as a pragmatist opposed to systematic metaphysics. The truth is that James dedicated especially his later years to developing a general metaphysic with two main, sometimes divergent, strands:

1. radical empiricism, and
2. a mystical pluralism,

advanced as the main alternative to, but by no means without kinship to, the absolute idealisms of Josiah Royce and F. H. Bradley.

Radical empiricism holds that there is just one basic stuff of the universe out of which all things, and in particular the physical and the mental, are made. This is pure experience, of which the fundamental units are certain so-called natures (much what later philosophers have called *qualia*). James qualifies the ontological force of the doctrine on occasion by saying that there may be other sorts of reality but that these, being unknowable to us, cannot figure in our account of things. He also sometimes suggests that 'experience' is a collective term for anything we might directly come across, and does not imply any genuine common character in what it covers; however, the main doctrine is clearly that the world is composed of elements of the same essential type as those which figure as the ingredients of human and animal streams of consciousness.

These natures occur in various different streams, as one might say, of being. In some of these streams the natures are related to each other so as to constitute streams of consciousness, while in others they constitute streams of being which are the biographies of physical objects. A mind knows a physical object directly or perceptually when the stream of consciousness in which its life or biography consists coincides temporarily with part of the stream in which the object's biography consists; it knows it indirectly or representationally when some element of current consciousness prepares it to know the object directly and cope with it successfully in that event. (This is the heart of James's pragmatist conception of truth.)

The theory hovers between two apparently different conceptions of a physical object. Perhaps these can be combined in some way, but James, who died still struggling with a final statement of his views, left their relation incompletely worked out.

1. On one conception its biography is a stream of being, consisting (or at least partly consisting) of the kinds of nature or qualia which occur in a human or similar consciousness when the object is perceived. This is similar to Bertrand Russell's one-time view that a physical object is a sequence of complexes of sensed or unsensed sensibilia. On this view a physical object is not thought of as intrinsically conscious (though of course those which are animal organisms may produce and be influenced by an associated stream of consciousness); rather, consciousness consists in a particular arrangement of such natures in which they interact to form purposive patterns guided by memory.
2. On the second conception, which is panpsychist in character, the streams of being which make up the biography of physical objects (or at least of more ultimate physical objects) feel themselves in a unitary way, and are what the life of the physical object is in itself rather than for us.

James tended more and more to this second view, but it threatens to deprive radical empiricism of one of its original charms, of letting a perceived object figure as an actual ingredient in current consciousness, for it is hard to see how our percepts can actually be components of the thing perceived if that is identified with its own felt inner life. However, James was also seeking a radically empiricist view of the relations between distinct minds according to which different streams of human and other consciousness

may in principle actually merge (even if, in practice they only come to the brink of doing so) when they perceive, or perhaps even when they conceive, the same object.

In its first version, radical empiricism is surprisingly atomistic, holding that the same nature can occur in different contexts without alteration. (It is sometimes obscure whether this is a matter of the same particular, or the same universal, doing so. James doubtless believed that natures straddle such a division, but ambiguities remain.) Thus an element of the table which I see might occur without difference in my stream of consciousness and/or yours and/or in the stream of being of the table. This clashes strikingly with the holistic view of consciousness taken in *The Principles of Psychology*, according to which no element of one moment of consciousness can be totally identical in character with (still less be the very same particular as) one occurring in another. And this holistic view of consciousness is important in the mystical pluralism of much of James's later writings, for which the world consists of streams of unitary pulses of experience, in which each pulse reflects the character of environing ones. However, even here environing pulses overlap in a way which James conceives as allowing a mediation between atomism and holism. In this context James suggests that there is a mother sea of cosmic consciousness from which our individual streams emerge and to which they return bringing various enrichments, thus providing a kind of semi-immortality similar to that urged by A. N. Whitehead and C. Hartshorne.

Related to the holistic-atomistic tension in James's thought is a tension between a conception of process which stresses the continuity of time and a quantic or epochal view of time, anticipating Whitehead. James agreed with Henri Bergson that there were features of time which could not be satisfactorily caught in conventional (and allegedly static) concepts. Another late development in James's thought was his endorsement of a kind of Platonic realism about universals or concepts. Though death robbed us of its final statement, James's metaphysics is profoundly probing of deep metaphysical and ontological questions of the kind most neglected by analytical philosophers.

Essential books of James for his metaphysics are: *The Principles of Psychology* (New York, 1890), *A Pluralistic Universe* (New York, 1909), *Some Main Problems of Philosophy* (New York, 1911), and *Essays in Radical Empiricism* (New York, 1912).

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TIMOTHY L. S. SPRIGGE

John Buridan

John Buridan was born *c.* 1299, probably in Béthume, and died *c.* 1358 in Paris. He was a French logician and natural philosopher, a pupil of William Ockham, and a representative of Parisian terminism in both its metaphysical and natural–philosophical variants.

Buridan starts out from the idea of an incommensurability of metaphysics, of theology, and of science or philosophy of nature, arising from the underivability of the principles underlying each from any of the others:

1. The '*propria principia*' of natural science have proved themselves before the authority of experience.
2. The '*communia principia*' of metaphysics are given with the knowledge of concepts.
3. The principles of logic determining the criterion of scientific rationality begin with the '*primum principium*' of knowledge, the so-called '*principium identitatis et contradictionis*' which is built up from the principle of identity – what is is what is; the principle of contradiction – nothing is and is not at the same time; and the principle of excluded middle – anything either is, or it is not. By the iteration of negation and of the modalities, a multitude of forms of these principles is possible.

Buridan presented the logical principles in his commentaries on Aristotle's *Metaphysics*

(*In Metaphysicam Aristotelis Quaestiones argutissimae Joannis Buridani*, Paris 1518) rather than in his treatise on logic entitled *Summulae de dialectica* (Paris, 1487). In the latter he establishes what it means to speak of the identity and diversity of concepts. This has a real sense, he holds, only when there is some reason to identify or to distinguish the qualities or attributes of objects. According to his commentaries on Aristotle's *Metaphysics*, the truth resides in that sort of simple apprehension in which an individual object is grasped by means of a nominal concept. The so-called Law of Buridan is: "*Omnis simplex apprehensio est vera, et nulla est falsa*" (*In Met.* VI, qu. 6). Every non-truth derives only from the form of a sentence, where subject and predicate do not stand for the very same thing. The dependence of the use of a term on the way of thinking of a given speaker is not decisive for the truth of a sentence, since truth always depends on the '*suppositio*', which is an objective property of terms, namely, the capacity of the sentence to be used as a statement. Only the categorematic terms have meaning in this sense, the syncategorematic terms, including the copula 'is', express an extensional relation between categorematic *significata*. The theory of meaning (i.e. theory of *suppositio*) and the theory of reference (i.e. theory of *significatio*) are then developed through an elaborate analysis of what were known as the 'properties of terms'.

According to Buridan both the act of signifying (*actus significandi*) and the act of understanding (*actus intelligendi*) are capable of relating both to the universal and to the singular. Which of these is the case depends on the perspective through which the act of thinking relates to the object of perception. For according to Buridan universals can only exist as terms and not in nature; they express only similarities between singular things. Unlike the singular, the universal is only given in the soul ('*animus*').

The objects of science are the *complexa* or mental propositions which form the basis of demonstrative science about the things. What a mental proposition signifies is only the *significata* of its separate categorematic terms, each of which stands for some separate thing. The mental sentence and reality do not conform to each other (i.e. with Buridan there is no underlying theory of representation), because the sentence always presupposes a predication, a comparison. Thus the unity of a thing always corresponds to a bipartite sentence.

Different sciences analyse the objects of science under different aspects (*connotationes*). Scientific sentences never treat of concrete substances and their concrete accidents but always of universal terms, which naturally denote, and their '*passiones*', i.e. connotative concepts.

Scientific sentences with a '*suppositio naturalis*' (a term introduced by Buridan) express 'matters of fact' which produce a maximum of agreement among scholars. Buridan provides an impressive demonstration of such sentences with his theory of *impetus* which serves as a model of explanation for the spontaneous motion of projectiles and celestial bodies. The underlying principle is the principle of Aristotelian causality of motion, according to which everything that moves is moved by something else. As moved quality in the face of the moved body, the impetus is a qualitative passion, that is an immediate principle of movement.

We find something similar in Buridan's theory of money and value, which is based on the principle of limited determinism: the will can be free only until that point is reached where reason decides what it holds to be the greatest benefit. After that, the will must follow the decision of reason.

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GÜNTER SCHENK

John Duns Scotus

John Duns Scotus was one of the greatest medieval philosophers. Born in Maxton, Scotland, *c.* 1265, he studied at Oxford and later in Paris where he was made professor. He taught at various times in Paris, Oxford, and finally Cologne, where he died in 1308. His fundamental works, and those whose authorship is undisputed, are: the treatise *De primo principio*, the *Quaestiones in metaphysicam*, the *Opus Oxoniense*, and the *Reportata Parisiensia*. The attribution to Scotus of the *Theoremata* is still disputed, even though notable scholars (such as Etienne Gilson) have declared its authenticity.

Scotus's philosophy starts from a theory of knowledge that bears the stamp of Aristotle, but also introduces important novel elements. Primarily, Scotus makes a distinction between two different forms of knowledge, namely abstract and intuitive. The former is characteristic of science, which abstracts from the present existence or non-existence of its object. Intuitive knowledge, by contrast, relates to its object in so far as it exists and in so far it is knowable by the knowing subject as existing at present (*Op. Ox.* II, d.3, q.9, n.6). It belongs not only to sensibility, but also to the intellect. It follows that there are two levels of intellectual knowledge, an intuitive and an abstract, and the whole of Scotus's metaphysics is founded on the relation between them.

Scotus assumes that external reality is made up only of individual things and that universality subsists as such only in the intellect. He then looks for the single common foundation of both the individuality of external things and the universality of the concept as thought. He finds it in the *quidditas*, which is the unitary essence – expressed by the definition – common to all the things of the same kind. The *quidditas* is therefore a real unity, for it is the essence and the unitary 'measure' of *real* things. Yet it is a lesser unity than is numerical unity: indeed, if it were a numerical unity, it would have to be added as *another* individual reality to the individuals belonging to the same kind or species. In itself the *quidditas* is neither individual nor universal, but is rather *per se* indifferent to both individuality and universality, for logically and ontologically *it precedes* them, though it never really exists without one of these two determinations. By virtue of this priority it is considered in itself by metaphysics (*Op. Ox.* II, d.3, q.I, n.7).

Concerning the problem of *individuation*, Scotus disagrees with Thomas Aquinas, objecting that individuation cannot depend (in Aristotelian terms) on the material cause: matter, as the indeterminate foundation of reality, cannot be the principle of distinction. Neither can it be the form or essence that, as we have seen, is the *quidditas* (that precedes both universality and individuality). For Scotus, then, individuality is due to a real dimension of being which is ultimate and doesn't reduce itself to the other dimensions and which determines the common essence in individuality, which is to say that it lets the being be this determinate thing (*ad esse hanc rem*). Scotus, or one of his followers, called this principle *haecceitas* (i.e. 'thisness': *Rep. Par.* II, d.12, q.5, n.1, 8, 13, 14).

The *quidditas* and *haecceitas*, although real determinations (and not purely mental ones) are not two numerically distinct realities: there subsists between them, in any given particular being, a formal objective distinction (*distinctio formalis in re*). The intellect's object is the intelligible species, by means of which it represents reality to itself in the guise of universality. The earlier clear knowledge of the intellect is the most universal one: the notion of *being*. This concept is included in all the other (narrower) concepts: thus all of them presuppose it.

Metaphysics, which has as its object precisely the concept of being, is therefore presupposed by all the sciences, conditioning them and making possible the principles upon which they are founded (*Op. Ox.* I, d.3, q.2, n.22–5). In disagreement with Thomas Aquinas, Scotus, deeply influenced by Platonic and Neoplatonic ontology, maintains that being is *univocal* in character: it is beyond all categories and generic determinations and is, as such, 'transcendent'. If it were not so, it would be impossible, according to Scotus, to know anything about God and to piece together a natural theology. To acknowledge the univocal character of being

entails, in fact, to admit a meaning of being which is common to God and creatures. This common meaning allows us to define by means of the notion of cause some attributes of God starting from the knowledge of the created perfections (*Op. Ox.* I, d.3, q.3, n.9; *De primo principio*, 3, 9, II).

See also: **Distinctions; Peirce II; Scotism.**

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ALBERTO JORI

John Gerson

John Gerson or Gersonides was born in 1288 in Provence. Little is known of his personal life, except that he provided services in philosophy to Pope Clement VI while commissioned at the papal court in Avignon. He died on 20 April 1344. His work is an attempt to integrate the teachings of Aristotle, as mediated through the eyes of Averroes and Moses Maimonides, with those of Judaism. His major work, *Milhamot Hashem (Wars of the Lord)*, was completed in 1328. In addition, John Gerson also composed commentaries on Averroes's commentaries on Aristotle.

In *Milhamot* John Gerson specifies six issues of concern: immortality of the soul, prophecy, divine omniscience, providence, astronomy, and creation. It is in the context of these issues that his metaphysical views are developed. John Gerson rejects Platonic realism, arguing that particulars are ontologically prior to universals. In *Milhamot* 1.10 he addresses the specific question of how intelligibles signify extramental entities. He rejects the view of Alexander of Aphrodisias (fl. 2nd/3rd centuries) that the intelligibles refer to universals, his own position being that the universal is neither a species or genus nor a plurality of individuals; rather, a universal term refers distributively to each individual that falls within the range of the proposition in question. The main implication of this position is that the intelligible does not differ essentially from its extramental existent, for both are ultimately individual in nature. Gersonides here presents a quasi-nominalist position according to which both the intelligible and its extramental referent are individuals in the sense that both represent ultimate realities.

This doctrine of individuals, particulars and universals has implications when John Gerson turns to the questions of immortality, prophecy, and – most importantly – divine knowledge of particulars. For example, with respect to the multiplication of species, he argues that although there is no need for more than one instance within each species, multiplicity arises ultimately as an effect of the Agent Intellect. Moreover, inasmuch as matter itself is unknowable, it is not the individual *qua* particular which is known, but rather the internal ordering of the particular; hence God cannot know particulars.

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TAMAR RUDAVSKY

John Philoponus

John Philoponus, the 'Grammarian' (*c.* 490–*c.* 570), was a Christian philosopher and theologian in Alexandria, a pupil of Ammonius Hermeae (late 5th–early 6th century)

who had studied under Proclus in Athens. He began his literary career by publishing commentaries on Aristotelian treatises, some of which are based on Ammonius's seminars. Seven works are extant: *In Categorias, In Analytica Priora, In Analytica Posteriora, In Meteorologica, In Generatione et Corruptione, In de Anima*, and *In Physica*. Philoponus frequently adopts a critical attitude towards Aristotelian tenets and strives to develop alternative views. Thus, for example:

1. He rejects as incoherent the Aristotelian notion of *prime matter* as conceived by the Neoplatonists who took it to be both incorporeal and formless. For Philoponus, in contrast, the most fundamental level of physical being is constituted by unqualified but *corporeal three-dimensional extension*. An upshot of this ontological point is that Philoponus revises the Aristotelian scheme of *categories*, viewing quantity (extension) no longer as an accident of substance but as its essence.
2. Whereas Aristotle defined *space* as the inner surface of body, thus conflating the concepts of 'space' and 'place', Philoponus links space with the notion of the *void* and defines it as spatial extension which is void according to its own definition, but in fact always filled with body.
3. Aristotle suggested that the *speed of a falling body* is proportional to its weight and indirectly proportional to the density of the medium through which it travels (thus implying the logical impossibility of empty space as speed therein would be infinite, *Phys.* 4.8). Philoponus, in contrast, emphasizes that the speed of a body depends primarily on the body's kinetic momentum, so that even in the void its speed would always remain finite; in a medium the speed decreases in proportion to the medium's density.
4. Aristotle implausibly explained *projectile motion* by appeal to a medium's supposed ability to propel the projectile along; Philoponus proffers his celebrated *theory of impetus*: a kinetic force is imparted by the mover to the projectile and exhausts itself in the kinetic process.

Philoponus's middle period is marked by two major works, the *De aeternitate mundi contra Proclum* and the *De aeternitate mundi contra Aristotelem*. Here he tackles the notorious doctrine of the world's eternity. In the first work, a detailed refutation of a pamphlet written by Proclus who defended the doctrine of the world's eternity, Philoponus proposes old and new arguments for *creation* and, importantly, attempts to vindicate philosophically the dogma of *creatio ex nihilo*. In the second treatise, extant only in fragments, he repudiates Aristotle's postulation of an incorruptible celestial element (*aether*; cf. *De Caelo* 1) as well as his arguments for the eternity of motion and time (*Phys.* 8).

In his later period, Philoponus offers a philosophical interpretation of the book of Genesis (*De opificio mundi*) and tries to influence the theological debates of his time. Several short treatises speak out in favour of the doctrine of the singularity of the nature of Christ (monophysitism): since a substance is identical with its essence or nature one must also assume 'one nature' – a harmonious combination of divinity and humanity – in Christ. Other works interpret the Trinity as three distinct individual substances of the same divine species which is taken to be a universal existing only in our minds. The Council of Constantinople in 680 condemned Philoponus's theological views, yet his philosophical ideas were disseminated among Byzantine and Islamic thinkers and eventually re-examined in the Renaissance both by Aristotelians and by the 'new scientists'.

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CHRISTIAN WILDBERG

John of St. Thomas

John Poinsot (1589–1644) took the name John of St. Thomas on entering the Dominican Order, signifying his intention to be faithful to the doctrines of St. Thomas Aquinas. The son of an Austrian, he was born in Lisbon. He studied at Coimbra and Louvain and taught at Alcalá (1613–43), during part of which time he was confessor to Philip IV of Spain. He died in Spain, at Fraga.

During the 1630s he wrote a *Cursus theologicus*, which is in fact a commentary on Aquinas' *Summa Theologiae*, most notable perhaps for the treatise on the gifts of the Holy Spirit which is generally taken as normative for Dominican spirituality. In morals he aligns himself against rigorism with the 'probabilist' school of his time.

The *Cursus philosophicus Thomisticus* (1631), an original work, is divided up into an *Ars logica* and a *Philosophia naturalis*. The first was intended to be the full-length work on logic that Aquinas never wrote. Thus it is designed to keep alive the Aristotelian and Avicennian three-level or 'intentional' tradition, defended also by Aquinas, against the 'two-level' nominalist semantics.

This *Cursus* was a strong influence on Goudin's *Philosophia juxta D. Thomae Dogmata* (1676), which kept Thomism alive through the early 18th century, and is a source of much in Jacques Maritain (e.g. his logic and the theory of the three degrees of abstraction) and of the logical work of the American realists, especially Henry Veatch.

But John was at his most original in his treatise on the theory of *signs*. He rejects Augustine's definition, according to which "a sign is something which, besides the impression which it conveys to sense, makes something else come into cognition" (*Cursus philosophicus* 646a 14–28), as applying only to 'instrumental' signs, though for Aquinas such signs, as objects of sense, were t primary signs (*Sum. Theol.* III 60, 4 ad. John of St. Thomas's more general definitic "that which represents something other th itself to a cognizing power", by eliminati reference to sense, takes in 'formal' signs well.

The latter are the immanent products the three acts of understanding distinguish by Aristotle, viz. concept, judgement, syllogism.

A formal sign is the actual awareness itself whic without any intermediary, represents. An instr mental sign is one that represents something oth than itself on the basis of a pre-existing cognitic of it (10a 4–12).

A formal sign is thus an entity the whol being of which is to refer to another. It there by founds the possibility of any referrin entities at all.

Hence the nature of this 'sign' is that of relation only; it is wholly *ad aliquid*. Joh took the term *signum formale* from Peter c Fonseca, where it had stood for the interna sense-image, such as a retinal pattern or a auditory vibration in the ear, which althoug not cognizable by the subject of them ar nonetheless observable to others and henc not just a relation. Thus André de Mura judges that John stretches the notion of a sig too far when he deprives it of any forma mediating function. Moreover if, as Thomist claim, the object is immanent in the intellec to the extent that our act of understanding i a relation of (intentional) identity with th object, then talk of a *sign* seems to offer neec less openings to Scotist or Lockean theorie of mediating representations. Thus John ca speak, Scotus-like, of an actualization c mind by the *species* or idea-impression ir stead of by the object (*Philosophia natural* IV 4, 1).

John held, with the tradition, that a rel tion existed as only a *reference* to anothe having all its being in the founding subjec which is here the thinker (*Cursus phil sophicus* I 580a 32–582a 16). This mak reference to the non-existent intelligibl One can thus offer a relational theory c mental acts as such, instead of reducing the to the *quasi*-relational, as Franz Brentan

would have it. While retaining the scholastic term Brentanists have altered the *theory* of the intentional, as if it arose out of the truth-conditions for types of *statement*, instead of being a properly logical relation of identity which founds reference rather than assumes it. These formal signs or *verba interiora* (concepts etc.), the mental acts, are thus for John relations *secundum esse* or really, and not just *secundum dici* or 'quasi-relational'.

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STEPHEN THERON

John Scottus Eriugena

John Scottus Eriugena, as his name testifies, was born in Ireland around the first quarter of the 9th century, but of his life (and in particular, education) in Ireland we know nothing. He is found definitely in Francia (corresponding only approximately to the France of today) around 850 at the court of Charles the Bald, somewhere in the general area of Laon. There he seems to have taught at the palace school until 870, or perhaps 877, after which we have no dependable information about him. Legend has it that he founded the University of Paris – or again, Oxford – and was killed by his pupils with their *styli*.

He would appear as a teacher to have interpreted the *De nuptiis Philologiae et Mercurii* of Martianus Capella (*c.* 4th–5th centuries), the most famous handbook on the liberal arts in those times, and also became notable for an unusual knowledge of Greek. Presently he was invited by the archbishop of Reims to controvert Gottschalk (805–868), who maintained that men were predestined not only to salvation, but also to damnation. Eriugena based the argument of his *De divina praedestinatione* on the necessary simplicity of God which in effect eliminated the possibility of predestination altogether. His book did not meet with ecclesiastical approval. On the other hand the king prevailed on him to employ his special knowledge of Greek in translating works of the Pseudo-Dionysius, alleged to have been a disciple of St. Paul (Acts XVII, 16–34) and founder of the king's own abbey of St. Denis at Paris. Pseudo-Dionysius in fact depended on the Neoplatonic Proclus for his doctrine. Eriugena was then asked by the king to translate the *Ambigua ad Johannem* of Maximus the Confessor (*c.* 580–662), which in due course led Eriugena to read and translate not a work by Gregory of Nazianzus (*c.* 330–*c.* 89), as he thought, but the *De opificio hominis* of Gregory of Nyssa (331–95). The doctrine of these three Greeks, deeply impregnated as it is with Neoplatonism, dominates the character of Eriugena's works, although these are placed, not always with success, in the context of the teaching of Augustine, revered by Eriugena as his doctrinal 'father'.

Eriugena's greatest work, which contains his characteristic teaching, is the *Periphyseon*, also known as the *De divisione naturae*, a study of being and non-being, of 'nature' in five books and some quarter of a million words. This is divided into the study of the Origin of being, God ("that which creates and is not created"), the primordial causes (*rationes*) of beings ("that which is created and also creates"), the effects of these causes ("that which is created but does not create"), and fourth the End of being, God ("that which neither creates nor is created").

We have here, then, an attempted Christian version of the Neoplatonic *progressus* (externation) and *regressus* (return) of all being from Itself as Origin to Itself as End. There are five modes of being:

1. whatever can be perceived by sense or intelligence is said to be: what cannot be so perceived is said not to be (e.g. God, who cannot be so perceived);
2. what is affirmed of a higher order of creature is negated of a lower: what is affirmed of a lower is negated of a higher (e.g. if an angel is an essential intellectual motion about God, then

man is not that – and if man is mortal, an angel is not);
3. visible things are said to be: their invisible causes are said not to be;
4. only things contemplated by the intellect alone are said to be: other things are said not to be (e.g. bodies);
5. when man sins, he is said not to be: but when he is restored by grace, he is said to be.

Essentially we can know only *that* God is, not what he is. He transcends all the categories of Aristotle. The negative (*apophatic*) way to God, which tells us what God is not, is more true than the affirmative (*cataphatic*), which purports to tell us what he is. Since there is no true essence apart from the Creator, it can be said that the Creator and the creature are one, but the Creator nonetheless is cause of the creature. The Bible is interpreted to tell us of the creation and the restoration of all things to their fundamental original state, although to the saints will be added a special joy, and to the wicked a corresponding sorrow.

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JOHN O'MEARA

Johnson, W. E.

William Ernest Johnson (1858–1931) taught at Cambridge from 1902. He was more influential as a teacher than through his few published writings: a three-volume *Logic* and papers on the foundations of logic and probability. Many of his ideas appear in the *Logic* of John Neville Keynes (1852–1949), with whom he co-operated. He influenced particularly F. P. Ramsey (1903–30), C. D. Broad (1887–1971), and the probability theory of John Maynard Keynes (1883–1946). Though trained as a mathematician, Johnson was more interested in philosophical foundations than in technicalities. In his *Logic* he develops a comprehensive ontology, viewing *propositions* as the subject of logic rather than judgements or sentences. Propositions are distinguished from *facts*. The former 'characterize' the latter, and there is a *characterizing tie*, which connects them. This same tie also connects *substantive* and *adjective* within a proposition.

Johnson uses the terms 'substantive' and 'adjective' to refer to ontological categories comparable to those of particular and universal. Adjectives, first of all, he regards as real universals and not as mere abstractions. Substantives, on the other hand, may be particulars. Not all substantives are particulars, however, since adjectives are also characterized by adjectives and thereby function as substantives. Johnson calls entities which characterize and are characterized 'quasi-substantives' in contrast to *substantives proper*, which are only characterized. The latter are the particulars. Propositions, now, belong to the quasi-substantives in virtue of their adjectives. These include true and false, which Johnson reserves for propositions and denies to judgements and sentences. The propositions in which the adjectives 'true' and 'false' occur are categorized by him as secondary propositions, a category which includes also modal propositions. Johnson acknowledges furthermore compound, general, and negative propositions. As to a similar categorization of facts, he is not explicit. However, he makes clear that to some general propositions there correspond no facts. He differentiates universals of fact covering only the actual from universals of law which extend into the possible. At some places he seems to recognize only singular facts. This is in accord with his statement elsewhere that to a single fact there corresponds an indefinite number of propositions which characterize it *more or less determinately*.

All characterizing entities are to the characterized as many to one. Also the characterizing entities are always graded in regard to determinateness, to specificity. For

the least determinate adjectives Johnson coined the term '*determinables*'. The substantives come in basic categories defined by clusters of determinables. They establish the respects in which a substantive is determinable, i.e. what kinds of adjectives can be tied to it. A surface e.g. has the determinables colour and shape and therefore can be characterized as red and square. Substantives proper also fall into the two kinds of *continuant* and *occurrent*. Continuants are the continually existing things, while their passing states constitute the occurrents, which are to be distinguished in turn from the adjectives of the continuants. The latter are connected to continuants by the characterizing tie, the former by the *tie of inherence*. There is, in addition, a third tie, the *asserting tie* which holds between an act of thought and the proposition it intends. Ties differ categorically from *relations*, which are adjectives, or more precisely adjective-couples characterizing substantive-couples.

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ERWIN TEGTMEIER

Judgement

The concept of judgement cuts across several philosophical disciplines:

1. In epistemology a judgement is a claim to have cognized or grasped something as true. It is the episodic manifestation of a subject's belief or of a change of belief.
2. In the philosophy of language a judgement is defined as the mental counterpart of assertion. Even though judgements need not be expressed in overt linguistic acts they can always be conceived as internalized assertions.
3. In the philosophy of mind, making a judgement is a way of relating oneself to an object. The object can be a simple one if the relation is established by accepting or rejecting something; complex objects are needed as relata if the relation is derived from attitudes like believing.
4. Finally, in formal ontology a judgement can be explained as a case of imposing a certain grammatical form upon a segment of reality. The projected structure is called a propositional form; what the judgement brings into being or locates in reality is called a state of affairs.

All four explanations hint at a relation between the *performance* of a judgement and *what is judged* in such a performance. This distinction has become famous as that between *act* and *object*, or more recently between *thought* and *content*. Quite apart from explaining these categories, this raises the problem of what *having* an object or *having* a content means. How one addresses this question will depend on which philosophical discipline (from the above list) one regards as competent in analysing the relation between an act and its object or content. In virtue of what do judgements mean anything? Should we appeal:

1. to our sensual experiences which bring us into contact with the external world,
2. to our capacity to understand sentences and thereby grasp the bearers of objective truth and falsity,
3. to the directedness towards a mind-independent object as the distinguishing mark of the mental, or
4. to the projections involved in passing from a world of disconnected objects to a world of interrelated facts?

The Classical View. An explanation of type (1) is given by the so-called 'idealist theory of judgement' according to which a judgement consists in the perception of agreement or disagreement between elements of consciousness. For such comparison to be pos-

sible, the elements must be given to the mind separately. The mind recognizes their identity or diversity and thereby unifies these elements into the complex content of a judgement.

This account received its classical form in the epistemological tradition of British empiricism, and was sustained particularly by the German idealists. Its starting-point is sensual experience, on the basis of which knowledge is gained by fitting together ideas which are in agreement or by keeping them separate if they are distinct (cf. John Locke's *Essay Concerning Human Understanding*, Book 4, xiv, 4). An advantage of Locke's theory, which partly explains its influence, lies in the fact that it agrees with traditional logic.

Aristotle had defined the proposition as a combination of subject and predicate. Locke, similarly, takes the act of judgement as a combining together of elements of thought. However, the logical combinations Aristotle is dealing with need not involve any commitment to truth or falsity. Thus it was natural to conclude that the unifying (or separating) aspect does not *exhaust* the notion of judgement. Kant draws this conclusion when he argues that for any combination of ideas to become a judgement it must include an awareness of 'objective validity' (B 141f., *Prolegomena*, §22). The classical view is thereby not refuted but only modified. Where Locke says that in making judgements we perceive some relation within our consciousness, Kant adds that we perceive this relation *as holding under objective conditions*. Other subjects may just as well realize these conditions to obtain on the basis of similarly related elements in *their* consciousness. This objective character of judgement plays a crucial role also in Edmund Husserl (cf. *Logical Investigations V*, Chapter 5) and, from yet another point of view, in logical positivism (cf. Moritz Schlick, *General Theory of Knowledge*, §8).

The Bolzano–Frege View. If judgements were confined to the mental synthesis of purely mental ideas, then their truth would be exclusively a matter of the private states of the judging mind. Bernard Bolzano and Gottlob Frege avoid such idealism or immanentism by introducing sentences-in-themselves and thoughts as objective bearers of truth and falsity (Bolzano, *Wissenschaftslehre*, §25; Frege "The thought"). Truths-in-themselves are not only supposed to exist independently of being affirmed; they are supposed also to be accessible to us without being acknowledged as true. The problem what it is for a judgement to have content is thus exchanged for the problem how such access is to be understood. What is it to *grasp* a sentence-in-itself or a Fregean thought, in contrast to understanding the utterances of a speaker or enjoying a reflexive awareness of one's own thinking? Provided with an answer to these questions we may then ask: what has to be *added* to the mere entertaining of a thought in order to yield a judgement? Frege describes a judgement as a step from the sense of a sentence to what the sentence refers to (cf. "On sense and reference"). But we do not know how to "advance from a thought to its truth value" unless we already know how to arrive at a thought in the first place.

The Bolzano–Frege approach does, however, have advantages from a linguistic point of view. There are two reasons for introducing objective truth-value-bearers into a theory of language. First, the same sentence can either be used to express a judgement or to express a mere content without any intellectual stand as to its truth or falsity. The latter is the case e.g. when the sentence occurs as the antecedent of an if–then clause or as a relative clause reporting a belief the speaker does not share.

Second, to every sentence expressing a judgement there are variant sentences expressing questions, promises, commands, etc. Though Frege did not develop a speech-act theory, his *Begriffsschrift* provides a special sign for the illocutionary force of judging. As M. Dummett has pointed out, this suggests adding to Frege's theory of sense and reference a systematic treatment of *assertion* (see his *Frege, Philosophy of Language*, Chapter 10). To a certain extent such an integrated theory of meaning and assertion might take the place of traditional theories of judgement.

Attitudes: the Psychological Aspect of

Judgements. The major obstacle confronting the linguistic approach is that of giving a unitary explanation for the use of sentences in making statements. What are we doing when we assert something? Since nothing is added to what is claimed to be true it might be assumed that the distinctive feature of an assertion can lie only in the attitude which the subject takes towards what it has grasped. Assertions can then be explained as the making public of such an attitude.

Attitudinal theories of judgement divide into two main classes, depending on whether propositions are or are not accepted as the objects of thought. Non-propositional variants have been developed by Franz Brentano, Bertrand Russell, Peter Geach, and Roderick M. Chisholm. Propositional variants are accepted by David Hume, John Stuart Mill, Alexius Meinong, and probably by the majority of contemporary philosophers.

The contrast between these different frameworks is often blurred by an inaccurate reading of Brentano. According to Brentano, every mental phenomenon is characterized by its directedness towards an object. Judgements are then to be understood as manifesting a special case of this directedness relation. The standard view is that in judging we are directed to what is claimed to be true. This explication, however, presupposes a notion of objects which are capable of being true or false, in contrast to objects like chairs and tables which either exist or do not exist. Only the former are 'judgeable', as Frege puts it. Brentano, however, claims that judgements are not directed to objects of a peculiar sort. If we can conceive of A, we can also take an intellectual or emotional stand with respect to A. This forces him to reject the subject/predicate analysis as revealing the general form of a judgement. Predicating that A is F cannot be the most basic form, since there are judgements of 'acceptance' and 'rejection' taking simply A as their unique object (Brentano, *Die Lehre vom richtigen Urteil*, p. 98).

Brentano insists that the object of a judgement is a *non*-propositional entity. If one judges that A exists, it is simply A, not A's existing, which is accepted. The term 'existence' adds nothing to the content expressed, just like Frege's assertion-sign. But whereas Frege puts his sign in front of complete sentences, Brentano uses it to turn a singular or general term into the expression of a judgement. This makes it impossible to quote any sentence of the analysed form '$A+$' or '$A-$'. Once we put the sentence in quotation marks it loses its assertive force. The only way of giving an example for an asserted sentence would be actually to use it for making a statement. It is such sentences-in-use which are of the form '$A+$' or '$A-$'. As soon as we mention one of them it will not exhibit this form any more.

Such difficulties are avoided in a multiple relation theory of judgement as first proposed by Russell in a paper "On the nature of truth" (*Proceedings of the Aristotelian Society*, 1906–7) but later dismissed in his essay on "The philosophy of logical atomism" of 1918. Like Brentano, Russell is opposed to the view that in making judgements we take an attitude towards some preconstituted proposition. Instead he claims that every judgement consists in a many-termed relation, the number of terms being theoretically unlimited. Many objections have been raised against this theory, most importantly that it does not explain the common feature in virtue of which all the multiple relations constitute a judgement. What distinguishes the relation between S, A, and F, if S judges that A is F, from any other relation which may obtain between these terms?

Geach, in his *Mental Acts* (1957), proposes a revision of Russell's theory which, he claims, solves this difficulty. The upshot of his proposal is that whenever a judgement-relation R obtains between S, A and F, there is an analogous relation R^* obtaining between S's conception of A and his conception of F. In virtue of this intramental relation R^* it is as if some 'mental utterance' of S represents the state of affairs that A is F. Here Geach relies on the idea of an 'inner language' and on a Tractarian picture theory of representation. But there might be other ways of rescuing the multiple-relation theory. At present the most promising candidate would seem to be Chisholm's theory of direct and indirect attribution, as expounded in his book *The First Person* (1981).

Where non-propositional theories of judgement are entangled with all sorts of difficulties, their propositional competitors are marked by a surprising simplicity and it has been in its propositional form that the explanation of judgement in terms of attitudes has had a predominant influence of late. The act of judgement, according to this kind of explanation, is (or at least depends on) an attitude towards a proposition. Here the term 'proposition' may be replaced by any expression designating a truth-value-bearer. After all, what makes propositions interesting for the judging mind is exactly their being true or false. Hence the attitude in question can only be some variant of *holding-true* or of *assuming* to be true (cf. Meinong, *On Assumptions*, 1902).

It has often been observed that a judgement is more than a mere sequence of concepts and ideas. But is there an additional ingredient which binds together its successive elements? Someone holding a propositional attitude theory will argue that in judging we take a stand towards what is already a unified whole. We cannot believe a mere conglomeration of ideas, but neither can we hope it or wish it, etc. Thus the problem of propositional unity is shifted to a more general level. It has no particular bearing on the notion of judgement but concerns equally all the other attitudes we may take towards a proposition.

It is exactly this incorporation into the larger project of a theory of propositional attitudes which lends apparent simplicity to the analysis of judgement. Once the nature of propositional attitudes has been taken for granted it becomes a matter of spadework to formulate necessary and sufficient criteria for the different kinds of attitudes. (John Searle's project of founding speech-act theory on a theory of intentionality proceeds along these lines.) However, there is still a need to explain what makes an entity a possible object of belief. The need for such a distinction as Meinong drew between 'objects' and 'objectives' makes the explanation of judgement in terms of propositional attitudes less simple than it appears at the outset.

States of Affairs: the Ontological Aspect of Judgements. A fourth possible approach to the theory of judgement starts from the premiss that judgements, along with questions, wishes, etc., have not *one*, but *two* different kinds of content. On the one hand, all these mental acts may share a content as their conceptual input, i.e. they may contain the same descriptive elements. But judgements are distinguished from the rest when their content is conceived as an output. Hence the output of an act cannot be fully determined by the concepts which it involves. A distinction along these lines was suggested by Husserl in his *Logical Investigations*, V, Chapter 4. Every judgement, Husserl says, *intends* a certain object, which can be specified whether or not the judgement is true. But what is it, Husserl asks, that *determines* the specified object to be the one intended in the present act? There must be something in the act which directs it to its object. Husserl calls that what directs the act to its object the *matter* of the act, what we have called its conceptual input. This he contrasts with the *quality* of the act, which may vary even if the matter remains the same. Now, if the content, taken as an input, is not sufficient for determining the content, taken as an output, the quality of the act must somehow contribute to this determination. We must expec the object of an act to depend on its quality Even if a judgement and a wish or question agree in their conceptual elements, they do not mean 'the same thing'. The judgement intends that such and such *is* the case, the wish intends that such and such *were* the case, and so on.

Husserl's initial move in this direction was introducing states of affairs as the objects of judgements. However, this alone would not suffice to distinguish judgements from other mental acts. One can not only *judge* that some state of affairs obtains, one can also conceive it without believing or 'positing' it, and one can even name it, as Husserl says. However, all these latter acts are 'modifications' of the act of judgement, which is therefore most directly linked to the state of affairs intended in each case (op. cit., §38). This is contrary to the view that one may first conceive a state of affairs and arrive at a judgement by *adding* a positing quality to it. Husserl opposes this view when he says that in judging "we perform not a mere succession

of presentations, but . . . a peculiar 'unity of consciousness' which connects the presentations. And in this connection the grasping of a *state of affairs* is constituted for us" (op. cit., §36).

The idea that judgement has intrinsically to do with 'formation' or 'constitution' was the modern view in Husserl's day. This can be seen from the book *Die Urteilsfunktion* (1895) of William Jerusalem (1854–1923) where we read that "in judgement a forming and structuring takes place of what is presented" (p. 76). It is important to notice how this view differs from Locke's dictum that judgement consists in a unification of ideas. The new spirit comes from what is taken to be the *result* of this unificatory process. For Locke the resulting judgement differs only in complexity from the ideas as separately given. Husserl might argue that the process of formation does not concern the matter at all. Rather the judging mind uses what is separately given in presentation for constituting a complex not of *these* entities, but of whatever these presentations are presentations *of*. From this it follows that states of affairs must be given to us as the complexes resulting from possible judgements. There is an *ontological* dependence here of the notion of state of affairs on the notion of judgement. It is claimed not only that we cannot *conceive* of states of affairs except *as* the intended objects of possible judgements, but also that there *are* no states of affairs without foundations in judgement. States of affairs are intentional objects, in the sense of being necessarily linked to the intentional phenomenon of judgement. This linkage can be defended only by referring to certain *formal* properties of states of affairs. They have to be considered as structured entities in such a way that for reality to contain such parts there must be judgements cleaving it apart in just these ways.

This formal aspect is best explained if we consider how states of affairs are represented in language. This is done either by complete sentences or by that-clauses. If we are Platonists about states of affairs it does not matter which of these grammatical forms we choose. But if we think of states of affairs as depending on some operation of the human mind, then it is the sentence which has priority. It is in sentences that we express our judgements. Hence it is in a sense the *grammatical* form of the (asserted) sentence which is projected onto reality.

However, such ontological modesty has its difficulties too. How are states of affairs related to facts? Is it sufficient to distinguish between obtaining and non-obtaining states of affairs or must we acknowledge positive and negative ones also? Adolf Reinach, a student of Husserl, classified states of affairs in both ways (see his "On the theory of the negative judgement", 1911, reprinted in Reinach's *Sämtliche Werke*). Ludwig Wittgenstein, in the *Tractatus* (1921), accepts the obtaining/non-obtaining distinction, but he has no use for negative states of affairs. Both conceptions may be criticized for not taking sufficiently seriously the requirement that states of affairs be merely *intended* objects. Thus they come near to reducing the ontological account of judgements to a variant of the propositional attitude theory. States of affairs whose obtaining is independent of being intended are just like propositions which are true or false independently of being grasped. The attitude of holding a proposition to be true is simply replaced by the attitude of taking a state of affairs to obtain. Only the terminology has changed.

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JOHANNES BRANDL

Jungius, Joachim

Joachim Jungius was born in Lübeck in 1587. He received his initial education at the Lutheran Gymnasium St. Katherinen. From 1606 to 1608 he studied metaphysics, including the works of Francisco Suárez, and some mathematics at Rostock University. He then went to Giessen, where he received the MA in December 1608. Shortly thereafter he became professor of mathematics. From 1612 to 1615 he worked in Augsburg with the educationalist Wolfgang Ratke (1571–1635). In 1616 he went back to Rostock to study natural science and medicine, and in 1618 he went to the medical school at Padua. On leaving Padua in 1619, he spent several years in constant movement, teaching Greek and mathematics at Rostock, medicine at Helmstedt, and practising medicine in Lübeck, Brunswick, and Wolfenbüttel. In 1622 or 1623 he founded a short-lived *Societas Ereunetica* in Rostock, the first learned society to appear in Germany. In 1629 he became rector of the two classical schools in Hamburg. In 1640 he resigned from the Johanneum, but remained rector of the Gymnasium until his death in 1657. It was during his rectorship that he carried out most of his scientific researches, and their effect is clearly seen in the development of the school curriculum. He instituted disputations on botany and entomological observations; he introduced atomist doctrines into the lectures on the traditional Aristotelian physics; and mathematics was taught with unusual thoroughness. Following a disputation in 1637, he became embroiled in a far-reaching theological dispute over the purity of the Greek used in the New Testament. The opposition thus aroused had an adverse effect on the reception of Jungius's other views, especially in logic.

During his lifetime three works by Jungius were published. *Bericht von der Didactica . . . Ratichii* (Frankfurt/Main, 1613) was written jointly with Christoph Helvich to recommend Ratke's educational methods and the use of the German language. *Geometria Empirica* (Rostock, 1627) was intended to elucidate Euclid in an empirical manner, particularly by demonstrating the equality of two figures by using paper cut-outs. The first three books of the *Logica Hamburgensis* were published in 1635, and the full work in 1638. After his death, many of his scientific papers were published, before two-thirds of them were destroyed by fire in 1679. The *Doxoscopiae Physicae Minores* of 1662 rejected Aristotelianism and adopted an atomist approach. The *Isagoge Phytoscopica* of 1678 made important contributions to botany, especially its nomenclature. Other volumes included the *Historia Vermium* and a work on mineralogy. Full details of all these publications are found in Kangro (1968). Mention must also be made of Jungius's inaugural addresses at Giessen in 1609, Rostock in 1626, and Hamburg in 1629, when he emphasized the role of mathematics as propaedeutic to both philosophy and the sciences.

Jungius's role in the intellectual history of his time was a varied one. He is hailed as one of the leading figures in the history of German education; his botanical work influenced John Ray (1627–1705) and, through him, Carolus Linnaeus (1707–78); and his work on atomism showed considerable originality, though it had little impact owing to the lack of publication during his lifetime. In particular, Jungius had a definition of 'element' which had been hailed as in some ways more modern than that of Robert Boyle (1627–91). Jungius's logic was notable for three things: first, its wealth of propositional inference forms, especially those involving different types of disjunction; second, its explicit acknowledgement of relational inferences, such as 'All circles are figures; therefore whoever draws a circle draws a figure'; third, its treatment of scientific reasoning, which owed much to Jacopo Zabarella (1533–89), but went beyond him in various respects, such as the attention paid to induction. Leibniz was to praise Jungius on a number of occasions for his empirical mathematics, his logic, and his scientific work; and he called him "one of the most able men that Germany has ever had".

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E. J. ASHWORTH

K

Kant, Immanuel
I: A Synthesis of Empiricism and Rationalism

Immanuel Kant was born on 22 April 1724 in Königsberg and died there on 12 February 1804. He studied philosophy, theology, and mathematics at the University of Königsberg, graduated for the master's degree and received the *venia legendi* in 1755. In 1770 he was appointed a full professor of logic and metaphysics. He lectured on history of philosophy, logic, metaphysics, ethics, pedagogics, natural theology, philosophy of religion, mathematics, physics, physical geography, and mineralogy. He was president of the university from 1786 to 1788. The works of his later, 'critical' period represent a grand unified theory of British empiricism and continental European rationalism. This conceptual synthesis had a tremendous influence on the development of philosophy. The critical realism of Kant's early publications shines through in his 'critical' works, which have often been misconstrued as an expression of idealism.

Early Atomism. In his early work *Monadologia physica* (1756), Kant advocated an atomistic conception of matter, stating that all physical bodies are composed of a finite number of absolutely simple substances. He rejected, however, both René Descartes's theory of corpuscles, in which matter is identified as extension without any force acting at a distance, and Sir Isaac Newton's postulation of mechanically passive atoms. Instead, Kant maintained a modified version of the Leibnizian theory of monads. Leibniz's monads are dynamic in an organic sense; they have a *vis viva*, a vivid, perceptive force without action at a distance. On the other hand, Kant's *monads* are dynamic in a physical sense; they are carriers of a repulsive and an attractive *external force*. These composition-dependent forces are inversely proportional to the third and second power of the distance, respectively. By virtue of its repulsive force, each monad has a sphere of influence which is impenetrable. This sphere of influence corresponds to the notion of an atom in modern physics, so that, apart from their indivisibility, Kant's monads correspond to modern atomic nuclei. Moreover, Kant accepted Newton's law of inertia and the law of conservation of momentum on impact. The *mass* of a body is proportional to the sum of the inertial forces of its monads. *Space* is infinitely divisible and, therefore, is not made up of monads; it emerges from the external relations of collections of monads. At this time Kant was influenced by Leibniz's relativistic theory of space. Thus, if two physical bodies at different times have the same external relations to an arbitrarily chosen set of reference substances, then they occupy the same position. The position of a substance x may be represented by the collection of all substances occupying the same position as x at some time. Hence, p is a position if and only if there is an x such that p is the position of x. Space for Kant in this early period may be conceived of as a three-dimensional continuum of all positions.

The Critical Philosophy. The theory of matter in Kant's works from the 'critical' period differs considerably from his earlier

atomistic view and is entangled in his complex epistemology. In the *Critique of Pure Reason* (1781) he propounded a conception which is in certain respects reminiscent of the Aristotelian doctrine of primary matter, and he tried to combine this tenet with a purely kinematic science of matter. He postulated a constant *persisting substance*, the thing-as-such (*Ding an sich*), which is the basis of all changes of phenomena. (This suggests a comparison between the thing-as-such and Aristotle's unmoved mover.) The existence of this persisting substance is a necessary condition for the concatenation of successive states in time. According to a further principle of Kant's, every transition from one state to another is subject to the law of causality. Moreover, as in his earlier period, Kant assumed the existence of an attractive and a repulsive force, both acting at a distance. The magnitude of these fundamental forces determines the state of matter as a persisting substance. We experience matter as a persisting substance by means of these forces only; all other properties of matter will remain unknown to us.

Knowledge results from the combination of sensuous intuition and conceptual thought. To Kant an *intuition* (*Anschauung*) is a singular idea (*Einzelvorstellung*) directly representing exactly one object, whereas a *concept* is a general idea indirectly representing several objects. In an intuition an object is shown, whereas in a thought a concept is shown and objects are thereby apprehended. A *pure intuition* exhibits only the space and time relationships under which an object is apprehended. In an *empirical intuition* a sensation is excited by an object. An empirical intuition presupposes the presence of the corresponding object and therefore is *a posteriori*, i.e., dependent on experience. The pure intuition, however, is independent of the spatial and temporal existence of any objects; it only depends on the capacity of the senses and is *a priori*.

During his critical period Kant held the view that *space* is a form of the intuition and that human beings discover all geometrical properties through this form. The knowledge acquired by means of the spatial intuitive form is said to be synthetic *a priori*. According to Kant, therefore, Euclidean geometry is synthetic *a priori*, i.e., an abstract description of the world of experience independent of the existence of particular objects of experience. This implies that the universe has an exact scale model. Kant tried in vain to find a synthesis of the Newtonian and Leibnizian theories of space by postulating that the universe is both finite and unlimited (and hence homogeneous). In his famous antinomy about space he grappled with the incompatibility of these properties and it was thus that he came to his conclusion that space is not an object but a form of the intuition.

The Aristotelian notion of designated matter (*materia signata* in the terminology of Thomas Aquinas) corresponds in certain respects to Kant's notion of matter as a *substance in space*. This aspect of matter can be constructed in the intuition by means of the two fundamental forces. As an object of the intuition, matter is completely reducible to the fundamental forces. According to the *Metaphysische Anfangsgründe der Naturwissenschaft* (1786), physics – in contrast to metaphysics and philosophy in general – should use only kinematic and dynamic concepts and get on without the primitive notion of matter. In contrast to the philosopher, the physicist employs exclusively pure and empirical intuitions and, therefore, does not need the concept of matter. The *quantity of matter* of a body must be determined in a purely kinematic manner by measuring the quantity of motion, i.e., the magnitude and direction of velocities and the length of time intervals.

The Synthetic *a priori*. According to the *Critique of Pure Reason*, metaphysics is the discipline of synthetic *a priori* knowledge. A true judgement is *synthetic* if it is not analytic, and it is *analytic* if it is equivalent to a true judgement of subject-predicate form in which the predicate is included in the subject. From Kant's exposition in the *Logik* (1800), it appears that a concept B is included in the concept A if and only if A is a conjunction of concepts: X and B and Y, where X or Y may be an empty conjunction. Hence, a judgement is analytic or synthetic depending on the definitions of its concepts.

In his discussion of mathematical judge-

ments Kant employed a generalized criterion of analyticity: a true judgement is *analytic* if it follows from the logical axiom of contradiction. If we combine Kant's two definitions of analyticity, we arrive at the Fregean notion: an analytic truth is one that can be derived exclusively from logical axioms and definitions. According to Kant, analytic judgements do not extend our knowledge. Thus Gottlob Frege, who adhered to the view that arithmetical truths are analytic, ran into difficulties when trying to account for the informativeness of arithmetical laws and numerical equations of the form of '$a = b$', where 'a' and 'b' refer to the same number in different ways. This dilemma was eluded by Kant who declared most truths of arithmetic to be synthetic *a priori*.

Kant's conception of the nature of arithmetical judgements is based on the presupposition that the concepts of arithmetic are conjunctions of simple concepts and that their properties can be discovered by a resolution into constituent marks. A further presupposition is the distinction between the notions of composition (*Zusammensetzung*) and addition. According to Kant, the arithmetical operation of addition can only be carried out by constructing examples in the intuition. This reference to the intuition constitutes the synthetic character of the judgements of arithmetic.

Other synthetic *a priori* judgements are the theorems of Euclidean geometry, ethical judgements such as the categorical imperative, and the so-called analogies of experience, i.e., the principles of causality and conservation of matter and a generalized law of gravity. The central problem of Kant's metaphysics is to show that such synthetic *a priori* judgements are possible. How can the truth of a non-logical judgement be comprehended without reference to experience? Kant tried to answer this question, which originated in David Hume's attempt to justify the rules of induction, by certain arguments in his transcendental analytics. These arguments are 'transcendental' in the sense that they start from *a priori* premisses and establish fundamental properties of our capacity for knowledge.

The proofs of the transcendental analytics depend on the notions of experience (*Erfahrung*) and phenomenon. In Kant's terminology, a *phenomenon* is a content of apperception which is apprehended by the pure self beyond space and time (in Kant's sense). The contents of perception may form either a chaos or a synthetic whole organized by the categories, which are concepts (such as quantity, quality, relation, etc.) embedded in the mind. An *experience* is a structured set of all contents of perception in a person's mind. A substance in space and time may be conceived of as a sequence of phenomena. Under this interpretation, a phenomenon is a substance in space at a particular time.

A transcendental proof essentially amounts to the deduction of a necessary condition of the following form: 'The set M of phenomena has the property P', from a judgement of the form of 'M is an experience'. A necessary premiss of such proofs is the 'fact of experience', namely that M exists. To guarantee that the conclusion is *a priori*, this premiss must also be *a priori*.

Kant's transcendental aesthetics, the science of the *a priori* principles of empirical knowledge, is based on an ontology reminiscent of that of Aristotle with its distinction between primary matter, designated matter, and pure form. Hence, we may say that part of the unstructured matter outside the mind (i.e., the thing-as-such) is mapped into a visual space in an empirical intuition. By this mapping the undetermined matter obtains a form, a structure. In a pure intuition, matter is disregarded and only pure forms are considered.

The Thing-as-Such. The notion of thing-as-such is one of the most elusive constructions in the history of philosophy. Yet a rational reconstruction of Kant's ontology depends on the interpretation of this notion. In order to achieve such a synthesis we may identify the *thing-as-such* as an open set D without any structure. We then consider a triple $<D, F, q>$ such that F is a set of one-to-one mappings of D into an *a priori* intuitive, three-dimensional Euclidean point set and such that q is a real-valued function of subsets of D obtained by denumerably many unions or intersections of subsets of D. The function q indicates the distribution of the *quantity of*

motion at a given time. The subsets of the basic set D are the ranges of definition of the F-functions; otherwise their elements have no representable properties. We shall call such a triple a 'transcendental structure' on D. A *phenomenon* (in the sense of a substance in space) is essentially a transcendental structure on the thing-as-such. A phenomenon at time t (in the sense of a content of apperception) is a structure $<D, f_t, q>$, where f_t is a member of some F and exhibits the geometric *form* of the phenomenon at t. The *position* of a region X of D in the F-configuration f_t is the region $f_t[X]$ of an intuitive space R. The *motion* of a phenomenon in R is a set of functions in F. A transcendental structure on the thing-as-such thus determines the physical properties of the corresponding phenomenon. Hence, the elements of F represent a kind of *interaction* (called 'affection' by Kant) between the thing-as-such and the intuitive spaces. The *pure self* is essentially an automorphism of the thing-as-such.

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JAN BERG

Kant, Immanuel
II: Kant's Metaphysics

Kant's metaphysics starts from a question: how is synthetic *a priori* knowledge possible? By 'synthetic *a priori* knowledge' he meant knowledge which is independent of experience, but which yet provides substantive information about the world – in contrast to our awareness of analytic truth, which he thought incapable of providing genuinely new information. Analytic judgements he defined as those in which the predicate concept is 'contained in' the subject concept, or more generally as those whose contradictories are self-contradictory. Their truth can be determined by examining the concepts concerned, so he thought (perhaps wrongly) that there was no great problem over them. The truth of a synthetic judgement cannot be established just by conceptual analysis.

Synthetic knowledge may be gained from experience, in which case Kant called it *a posteriori*. *A posteriori* knowledge seemed unproblematic too: experience shows us that the judgements in question are true. But Kant was convinced that we also have synthetic *a priori* knowledge, and cannot get along without it. The empiricists, and particularly David Hume, had left no place for it, but Hume's philosophy had ended in scepticism, and in Kant's eyes that helped to confirm the indispensability of the synthetic *a priori*.

Yet the problem it posed was acute. Since such knowledge is not gained from experience, how *can* it give us reliable information about the world? Previous German philosophers, and notably Christian August Crusius, had held that certain truths about the world were simply obvious to us, independently of any experience. But people differ on what seems obvious to them, and besides, why should the world be made so as to conform to what seems obvious to human minds?

Leibniz had offered an answer to the latter problem, following René Descartes. There is a pre-established harmony between the principles of human thought and the way the world is: a harmony set up by God. Kant thought this solution was hopeless. Except by relying on just such principles we can have no reason to believe in God at all, for we do not learn about him from experience. Moreover the other difficulty remains, that different and incompatible things can seem equally obvious. In a number of instances Kant thought he could construct equally plausible arguments, resting on equally plausible premisses, for two exactly contradictory conclusions: for example, that the world is infinite in space and time, and that it is finite; that the will is free, and that there is no free will because everything is determined. To

these 'antinomies', as he called them, the metaphysics of his day had no solution to offer.

The most straightforward case of synthetic *a priori* knowledge Kant took to be mathematics. Some philosophers have argued that mathematical truths are analytic, and at one stage he seems to have accepted this view himself. Further reflection led him to reject it, because mathematical truths appeared to be truths about space and time. Geometrical truths, he thought, conveyed information about the nature of space; arithmetical ones conveyed information about time, and about space as well. His first attempt at the problem of synthetic *a priori* knowledge was designed to deal with mathematics. It was put forward in his *Inaugural Dissertation* of 1770, in which he argued that space and time are not real things independent of us, but are somehow imposed by our minds on the world. They are 'forms of intuition' (*Formen der Anschauung*), as he was later to call them: frameworks within which our minds order the data we receive through the senses. (It is worth noticing that Kant uses the word 'intuition' (*Anschauung*) simply to mean 'immediate awareness of particular things'.) Geometry and arithmetic, then, which tell us about space and time, are true of the world because they are made true of it by us. Space and time do not need to be learnt about from experience, because they are supplied by our minds themselves.

This is, of course, a very radical idea, and it took Kant some time to think its implications through. In the years following the *Inaugural Dissertation* he was preoccupied with the thought that there are certain important concepts, including the concept of cause, which cannot be derived from experience, and the application of which cannot be verified in experience. Hume had argued, plausibly, that all we are ever directly aware of is that an event of one type is regularly followed by an event of another type. We never perceive any causal connection between them. Causal laws indeed seem to be in a sense necessary – otherwise they could not be called laws – and yet we never perceive this necessity. All we are aware of is the particular events. The concept of cause, Kant concluded, must be an *a priori* concept: a concept which cannot be learnt from experience, but of which it is still possible to know that it applies in the world – knowledge which must be synthetic *a priori*. Further reflection led him to the view that there are twelve, and only twelve, fundamental *a priori* concepts, and these he called categories. There are other *a priori* concepts as well, but they are derivative from the categories. The categories are organized into four triads: unity, plurality, totality; reality, negation, limitation; substance, cause, community (i.e. reciprocal dependence); possibility, existence, necessity. Such systematic organization may appear surprising, but Kant thought he could show that each category must correspond to one of the fundamental types of judgement studied by logicians, and he also thought he could show there must be twelve of these.

He believed every category must apply to the world, and apply to it throughout our experience of it. That itself would be a piece of synthetic *a priori* knowledge, but he thought there are also stronger claims which we can make in the case of each category, and which we can know to be true. These stronger claims, which are still synthetic *a priori*, take account of the fact that the world to which we must apply the categories is temporally ordered. They can do that without being any the less *a priori*, given that we know *a priori* about the spatio-temporal character of experience. (Temporal ordering is more important than spatial here, though, because all our experience – even our awareness of our own inner sensations – is temporal, whereas it is not all spatial.) These stronger claims he calls 'principles of pure understanding', and perhaps the most important of them are those concerned with the categories of substance and cause: the first asserts that there is some substance which is permanent throughout all the changes that ever take place in nature, and which never increases or diminishes, while the second asserts that every event has a cause.

In the *Inaugural Dissertation* Kant had held that only space and time were imposed by the mind on the world. This solved (he thought) the problem about mathematics, but the problem about other synthetic *a priori*

knowledge remained. His solution to that too, when it came, was on the same lines. In the *Critique of Pure Reason* (1781) not only the forms of intuition, but also the categories, are supplied by the mind. Because we provide them we can know they apply to the world: they apply because we read them in. The principles of pure understanding can be known because we build them into the world as we know it; in Kant's terminology, they are *constitutive* of it. The world as we know it is thus in large part the product of our own minds. He calls it the world of appearances (*Erscheinungen*), or the phenomenal world. We may contrast with it the world of things in themselves (*Dinge an sich*), or the noumenal world, which is wholly independent of us and of our cognitive capacities and thus lacks all those features which we read into the world of appearances – space, time, the categories, and everything that belongs to it in consequence of these. Kant holds things in themselves to be entirely unknowable.

The greatest controversies in interpreting Kant have been over the status of things in themselves. Some have denied that Kant thought they existed; others have held that at least he *ought* not to have thought they existed. It seems however that his theory requires their existence, and that he recognized this. They must be the source of the data we receive in sense-perception, for Kant does not suppose these data are contributed by our minds; if they were we could know about them *a priori*, but they provide the *a posteriori* element in experience which can only be known about empirically. In addition, if the world of appearances is in part the product of our minds' activity, our minds themselves must have an existence beyond that world: they cannot be their own creation. Thus when Kant says that things in themselves are unknowable, he presumably does not mean we cannot know they exist, but only that we cannot know anything about them.

We can know nothing about them because such knowledge could be neither *a priori* nor *a posteriori*. It is not analytic (since it concerns how things are), and synthetic knowledge, Kant had concluded, is possible only in two ways: either it must be read off from the world, or else read in. Synthetic *a priori* knowledge is read in, but nothing can be read in about things in themselves; the world of things in themselves is the world as it is independently of what we read in. Equally, however, we can have no *a posteriori* knowledge about what things in themselves are like. For all our sense-experience is intrinsically spatio-temporal, or temporal at least, so that before we can become aware of them we must have ordered whatever data are given to us from outside in accordance with the forms of intuition (space and time) which we ourselves supply. We must have ordered them also in such a way as to read in the categories and the principles of pure understanding; and indeed Kant seems inclined to argue – particularly in the second edition of the *Critique* (1787) – that the application of *any* concept to experience involves a synthesis that is carried out by the mind spontaneously and which cannot be 'borrowed from', or determined by, the nature of things as they are in themselves. Our sense-experience, therefore, owes its character in part to things in themselves, but there is no way for us to infer what these things in themselves are really like.

Kant called his philosophy transcendental idealism. That it is a kind of idealism is clear enough: the world of appearances is partly a product of the mind's own activity. But calling it the world of *appearances* may suggest that it is in some way an illusion, and this Kant was most anxious to repudiate. He wanted to show that it is public and shared, and meets all our standard requirements for objectivity. When he thought only space and time were mind-imposed, this did not seem much of a problem, for the spatio-temporal framework is undeniably public. But when he came to hold that other concepts were imposed by the mind as well, the question arose whether their employment did not simply reflect a widespread mistake. This could, indeed, be taken to be Hume's view about the concept of cause. What is the difference between our imposing a concept on the world, and our misinterpreting the way the world is by using a concept that is merely fictional, like the concept of witchcraft or (to take Kant's own examples) of fortune and fate?

He found the answer in a form of argument which he had already made use of in the *Inaugural Dissertation*, though not very explicitly. This consisted in arguing that such and such must be the case because otherwise experience would not be possible at all; or at any rate, experience of the kind that human beings incontestably possess. Thus, no experience – except perhaps God's – would be possible without forms of intuition, frameworks which perform the function that space and time do for us. Similarly, Kant thought, no experience – except perhaps God's – would be possible without the thoroughgoing application to it of the twelve categories. Hence there can be nothing wrong with applying them, for there is no alternative, and we can be sure that everyone else will apply them too. His argument for this, which is the densest but also perhaps the most fertile part of the *Critique of Pure Reason*, he called the Transcendental Deduction of the Categories. 'Deduction' is a legal term for 'justification'; by 'transcendental' Kant usually means, as he does here, 'necessary for experience'. Arguments of this general kind have come to be called transcendental arguments. Kant thinks he can show by using such arguments that each of the principles of pure understanding must apply to the world as we know it, and that it is only by applying these principles – and in particular the principle that every event must have a cause – that we can distinguish the objective from the subjective within our experience. Thus, far from being illusory, the categories and the principles are essential to our being able to operate a standard of objectivity at all.

The mistakes of traditional metaphysicians arose, he thought, from failing to realize that our knowledge is limited to the world of appearances. There are certain metaphysical mistakes we all find very natural, and they consist in drawing conclusions about the self, the world as a whole, and God – conclusions which are illegitimate because they go beyond all possible experience, and hence beyond the world of appearances. To argue, with René Descartes, that the self is a simple and immaterial substance is to make such a mistake: the self as we know it is the self as we find it in experience, and though it may have a ground in the noumenal world we can know nothing about that. The world of appearances does not exist as a totality – we can have more and more experience, but according to Kant there is no totality of possible experience, so questions about whether the world is finite or infinite in extent simply collapse. So do questions about the infinite divisibility of matter, for though experience could teach us about further and further divisions it could never tell us about a completed series of divisions. The traditional arguments for the existence of God are invalid, and bound to be so, for God could never belong to the world of appearances. All the same these *ideas*, of the self as a simple substance, of the world as a whole, and of God as a designer who has arranged nature as a systematic unity comprehensible to us, are of indispensable value if we treat them as *regulative*, that is, use them to guide us in our search for knowledge of the world around us: that search can be carried on effectively only if we proceed *as if* these ideas matched genuine realities.

One of the principles constitutive of the world of appearances is that every event has a cause. Yet it is hard to avoid thinking of ourselves as free, in a sense incompatible with causal determinism. There is at least a possibility, Kant thinks, of reconciling this contradiction by the thought that although as phenomenal entities (i.e. as belonging to the world of appearances) we are causally determined, yet as noumenal entities (as things in themselves) we may be free. Again there is a possibility that amongst the noumena there might be an absolutely necessary being – God. These possibilities, which can never be more than possibilities for speculative metaphysics, are converted into actualities in Kant's *moral* philosophy. We are immediately and directly aware of the moral law as binding on us; it is 'given' as a 'fact of pure reason' (*Critique of Practical Reason*, 1788). The moral law requires us to act out of a sense of duty, which means we must obey the 'categorical imperative': "Always act in such a way that the principle of your action could become, through your rational will, a universal law". But genuine moral action, and moral responsibility, would not be possible

(Kant believes) except for beings with free will. Morality, therefore, demands that we have free will, and since there is no room for freedom in the phenomenal world that means we must be free as noumena. He also argues, less convincingly, that it demands a God who arranges that virtue be rewarded, and personal immortality, so that we can receive the reward. Speculative metaphysics cannot tell us these things, yet they constitute 'knowledge from a practical point of view'. What exactly this amounts to is not wholly clear.

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RALPH C. S. WALKER

Knowledge

The ontology of knowledge is the philosophical examination of the nature and the extent (the objects) of knowledge, very much John Locke's project in his *Essay Concerning Human Understanding*. But it should not be simply identified with epistemology, since much, indeed most, of what is now called epistemology cannot be properly called ontological.

For example, an examination of the ordinary uses of 'know', such as that found in the writings of Ludwig Wittgenstein, J. L. Austin (1911–60), and Gilbert Ryle (1900–76), may be called epistemology, but all three of these philosophers would have denied that it is ontology. The reason is that by 'ontology' we understand a philosophical description of certain facts or aspects of the world, and not (except incidentally) a description of how we talk about these facts or aspects.

The ontology of knowledge must also be distinguished from the essentially normative concerns of many epistemologists. Most of what has been written in epistemology in recent decades has been about, or at least has presupposed, the definition of knowledge as *justified* true belief. Such writings can properly be described as belonging to 'the ethics of belief', which indeed is the title of the first part of Roderick M. Chisholm's *Perceiving*, the book that inaugurated the currently dominant approach in epistemology. This approach is also evident in A. I. Goldman's *Epistemology and Cognition*, though it is a merit of this book that much of it is concerned also with the ontology of knowledge.

Of course, in a very broad sense of 'ontology', the ordinary-language and the normative approaches to epistemology can be called ontological, since uses of words and normative epistemic properties (if there are any) are parts or aspects of the world. But it would be misleading to reject, for that reason, the distinctions made earlier. If philosophical knowledge of the world, i.e., ontology, is possible at all, then we cannot be concerned with just how we speak about the world. And even if there are normative epistemic properties, there is much more to the facts about knowledge than the presence of such properties. At any rate, it can be doubted that the normative epistemic judgements we do make are irreducibly such, and not analogous only to what Kant called hypothetical imperatives (as contrasted with categorical imperatives). Statements about what we are justified in believing seem to be hypothetical statements about what we ought to, or at least may, believe *if* we want to believe what is true. And the substantive questions are:

1. whether there is a relation between what is expressed by the antecedent and what is expressed by the consequent of such a hypothetical that renders the hypothetical true, and
2. what this relation is –

just as in ethics the substantive question about a hypothetical imperative is whether there really is the presupposed means–end relation.

(Similar questions would arise if epistemic notions were supposed to be aretaic, rather than deontic.) These questions are essentially ontological, even though we still lack non-sceptical and non-question-begging genuine answers to them in the case of the traditional epistemological problems, e.g., whether we can know that there is an external world.

The current preoccupation with the notion of justified belief is in part motivated by the desire to bypass these difficult ontological questions. But it seems also inherently misconceived. The term 'justification' is notoriously vague. Justification may be moral, prudential, legal, aesthetic, religious, etc. This is why contemporary epistemologists have coined the phrase 'epistemic justification' to identify what they mean. But then the definition of knowledge as justified belief would appear to be circular, and at any rate the notion of *epistemic* justification would need to be explained in terms of other, more fundamental and non-normative notions, one of which, *prima facie*, would be that of knowledge. (If any of these notions is normative, it would almost certainly present us with the same sort of difficulties.)

This indeed is what reliabilist theorists such as Goldman do, who explicate the justifiedness of a belief in terms of its genesis. But it is also the traditional approach, which was to appeal to notions such as apprehension and unthinkability of mistake. This latter approach is preferable to the reliabilist's, since it preserves the relevance of the philosophical topic of knowledge to the traditional epistemological problems, e.g., whether we can know that there is an external world, which have been 'internalist', i.e., understood strictly from the first-person, present-tense perspective, answerable only on grounds to which one has unproblematic epistemic access. One has no such access to the genesis of one's beliefs.

In the history of philosophy, discussions of knowledge and related topics (e.g., perception, belief, truth) have been almost exclusively ontological, in the sense I have indicated, and only derivatively concerned with linguistic or irreducibly normative issues. Contrary to the common belief today in Anglo-American philosophy, the traditional conception of knowledge was *not* that of justified true belief. Plato and Aristotle viewed knowledge as a kind of vision, apprehension, contemplation, and restricted its objects to universals. René Descartes viewed it as indubitability, better described as impossibility of mistake, and arguably what he really appealed to in claiming mistake in believing a certain proposition to be impossible was simply the brute but by no means irrelevant fact of finding such mistake inconceivable, *unthinkable*. David Hume (1711–76) defined knowledge as the assurance arising out of the comparison of our ideas, and by this he meant the *inconceivability* of mistake. Twentieth-century British epistemologists such as John Cook Wilson (1849–1915), H. A. Prichard (1871–1947), and H. H. Price (1899–1985) identified knowledge with apprehension, with a certain kind of awareness or consciousness. For Edmund Husserl (1859–1938) knowledge essentially rested on intuition, a direct confrontation of an object in consciousness. The traditional epistemological problems about what we can and what we cannot know were largely questions about what we can apprehend and about what we find indubitable.

So understood, the ontology of knowledge must at least begin with questions about the nature of consciousness and of its objects, its species, especially what have been called apprehension and intuition, and the fundamental event of finding mistake in believing a certain proposition to be unthinkable, inconceivable. An appeal to such an event is needed because even if we allow that knowledge is a certain mode of consciousness, say, apprehension, we must still ask why we hold it to be veridical, or if it is such by definition, then we must ask how we determine that we really are engaged in that, not another, mode of consciousness. Finding mistake unthinkable is a psychological event, but from an internalist standpoint ultimately one cannot appeal to any other kind of event or state.

But in order to deal with the question concerning the *objects* of knowledge, we also need to describe accurately and in detail the nature of sense perception, of memory, of the sort of awareness we have of the subject matter of mathematics, etc. Such descrip-

tions would be properly describable as ontological. Mere observations about ordinary usage, or systems of definitions intended to lead to a refutation of scepticism, are not a substitute for such descriptions.

There are questions about knowledge, still ontological, which are distinguishable from those mentioned so far. They concern the relationship between knowledge and the world. For knowledge is not merely a part of reality. It is also our measure of what to count as reality. Thus the familiar issues of realism vs. idealism (or irrealism), reality vs. appearance, truth as correspondence vs. truth as coherence, arise. They were the primary concern of George Berkeley, Hume, Kant, Hegel, and Husserl, and dominate much of recent Anglo-American philosophy.

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PANAYOT BUTCHVAROV

Knowledge Representation

The philosophically primary notion of representation has been that of a 'mental' or 'internal' representation. It covers the classical Greek and medieval notions of *phantasma* and *species in intellectu*, the modern notions of idea, *Vorstellung*, concept, mental image, sensation, and sense-datum, as well as the current notion of a functional state of the brain that is analogous to a formula or sentence.

There have been several motives for the wide acceptance of it, and of the representationalist theory of knowledge that is its home. The simplest and crudest is the assumption that, since in perception the object is ordinarily at some distance from us, we cannot be 'directly' aware of it but rather must be aware of something *in us* that at most represents it, presumably by being similar to it, though the similarity need be only highly abstract, perhaps even purely formal.

A second motive is provided by the facts of perceptual relativity: objects appear differently in different situations and to different observers. It is natural to suppose that these differences can only be differences between entities other than the object, yet serving as 'representatives' of it.

A third motive is the fact that non-perceptual consciousness, e.g. imagination, often has objects that do not exist, and it has been thought that this can be understood only as a case in which we are conscious not of the non-existent objects but of certain existent mental objects with which they are confused.

A fourth motive arises out of the acceptance of physicalism. On this view, what we ordinarily describe as our consciousness or awareness of an object (or state of affairs) can only be a state of the brain, but presumably one that in some sense represents the object (or state of affairs). Of course, such representing can be, at most, formal or even just functional similarity, and so the analogy with the operations of modern computers has appeared attractive to many.

There are at least two objections to the belief that there are mental representations. One is purely phenomenological and was stated most clearly in Jean-Paul Sartre's (1905–80) early writings, though it was anticipated by Edmund Husserl (1859–1938) and Martin Heidegger (1889–1976), and may be found also in Ludwig Wittgenstein (1889–1951) and Gilbert Ryle (1900–76). Sartre argued that when imagining Peter, it is Peter who is the object of consciousness, not any psychic simulacrum of him. A mental image of Peter is simply an imagining of Peter. Ryle argued that there are sensations only in the ordinary sense in which itches, tickles, and pains would be called sensations, and in which it is just false that there are, for example, visual sensations whenever visual perception occurs.

The second objection is dialectical. It too was made by Sartre, Wittgenstein, and Ryle, and most recently by Hilary Putnam. Even if

there were such entities as mental representations, they could not serve the function for which they are needed, since no relation they can bear to what they purportedly represent would be a sufficient condition for their representing that and not some other object, or indeed any object at all. Clearly, mere similarity or causal connection is not sufficient. In general, the objection is that representations must embody the intentionality, object-directedness, of consciousness, and that this they cannot do. Closely related is the familiar objection to the representationalist theory of knowledge that has dominated modern philosophy, namely, that it cannot explain why the alleged mental representations should be taken to represent an external material world, indeed why they should be taken to represent anything at all.

The alternative to accepting a theory of mental representations is what has been called direct realism: in consciousness we are in direct 'contact' with the object. There are three main objections to this theory.

The first is the physicalist's: no such contact or relation is or can be acknowledged by the physical sciences. But the force of this objection, directed also of course against any form of non-physicalist representationalism, wholly depends on the independent plausibility of physicalism, and physicalism is plausible only if it can offer an adequate account of the facts of consciousness, especially of its intentionality. That it can do this has hardly been demonstrated; it is more a matter of faith in 'the scientific picture of the world'.

The second objection is epistemological: how do we tell which objects (or which properties of objects) of such direct awareness are real and which are not? But this problem arises even more obviously for representationalism.

The third objection is ontological: how can there 'be' objects that do not exist, namely, those (or their properties) of which we are aware in imagination, hallucination, dreaming? But the puzzle arises largely through confusions and the power of misleading pictures. There is first the confusion of non-existent objects with sheer, undifferentiated nothingness. But philosophers, such as Alexius Meinong, who have held that there are non-existent objects, have explicitly denied this; a world of fiction is still a world, it must not be pictured as a mere blank. The second confusion is that between the general sense of 'there are', in which it carries no existential implications (e.g., 'There are many fantastic things I dream about'), and its restricted sense as a synonym of 'there exist'.

The notion of representation can also be applied to linguistic and artistic representations. But even if there is some similarity, at least isomorphism, between, say, sentences and states of affairs, and between portraits and certain persons, to see the former as *representations* of the latter one must be conscious of the latter independently, either through the presence of a *mental* representation or, as argued earlier, directly. This is part of Wittgenstein's objections to his earlier picture theory of language (in *Tractatus Logico-Philosophicus*) and constitutes the basis of Sartre's argument that ordinarily consciousness of 'material' images such as portraits is consciousness of the person represented by the portrait, the portrait itself serving merely as its 'vehicle'.

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PANAYOT BUTCHVAROV

Kotarbiński, Tadeusz. See: Reism

Kripke, Saul A.

Saul A. Kripke's (born 1940) major contributions to metaphysics are to be found in his paper "Identity and necessity" (Kripke

1971) and his three lectures published together as *Naming and Necessity* (1972, 1980). In these works, which are amongst the most influential in 20th-century philosophy, Kripke resuscitated interest in traditional essentialism, and then used essentialist principles he defended to contest one version of a materialist view of the mind–body relationship. Kripke has also done philosophical work on reference, truth, Ludwig Wittgenstein's later philosophy, Kurt Gödel's theorems, and identity through time and the emotions, but the results are either unpublished or not within my brief here.

Two of Kripke's most famous theses (1972) are *the necessity of origin* and *the necessity of identity* (though other philosophers had made both formal and substantial defences of the latter). He writes:

> Could the queen . . . have been born of different parents from the parents from whom she actually came? Could she . . . have been the daughter of Mr. and Mrs. Truman? . . . Perhaps in some possible world Mr. and Mrs. Truman . . . had a child who became Queen of England . . . This would still not be a situation in which *this very woman* was the child of Mr. and Mrs. Truman . . . (pp. 312–14).

This passage illustrates Kripke's distinction between what is epistemically possible in advance of investigation versus what has to be the case, given what is actually the case. It could have turned out that the present Queen is a daughter of the Trumans (epistemic 'could'), but given that in fact she is not, necessarily she is not: if E is a daughter of the Trumans in W then E is not Elizabeth II. More precisely, Kripke's essentialist thesis here is that the propagules (sperm and egg, in the case of humans) from which an organism develops are essential to it: in any world where the organism exists, it developed there from those same propagules.

The necessity of identity works in a similar way. Kripke treats such statements as 'Water is H_2O' as 'theoretical identities' (1972, p. 143), so that though it could have turned out that water isn't H_2O, granted that it *is* H_2O, there is no possible world where it is anything else. Even if XYZ in W appears to W's inhabitants as water actually appears to us, this is not sufficient for it to *be* water. See Graeme Forbes (1985) for further references and discussion of the justification of these doctrines.

Kripke then draws a contrast between the above cases and supposed theoretical identities advanced by some materialists, such as 'pain is C-fibre firing'. If this is a true identity, it should be necessary. But it isn't necessary, according to Kripke. If pain were C-fibre firing, we should have to redescribe a world postulated as one where there is pain but no C-fibre firing as a world where there is something that merely appears to be pain but isn't, like the worlds where a daughter of the Trumans appears to be Elizabeth II but isn't, and where XYZ appears to be water but isn't. But how can something appear to be pain but not be pain? The phenomenological content of the concept rules this out. Thus there are worlds where there is pain but no C-fibre firing, which means the alleged 'identity' is contingent and so not a true identity at all. For further discussion of this argument, see Colin McGinn (1976) and Christopher Peacocke (1979).

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GRAEME FORBES

Külpe, Oswald. See: **Würzburg School**

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Lambda Abstraction

Lambda abstraction is a method for generating terms from other terms, typically producing propositionally complex property terms from predicate expressions. There are several abstraction operations, including set and relation abstraction. But these can be reduced to property abstraction, which makes it convenient to speak of property abstraction as abstraction *per se*.

The notation of predicate logic is enlarged to include a specially defined term such as the operator λ in Alonzo Church's lambda-calculus, that binds object variables in much the same way as quantifiers or the definite description operator ι. If p is an otherwise well-formed formula that contains x free, then $\lambda x[p]$ is its abstract or lambda transform. More generally, if p contains n free object variables $x_1,\ldots,x_n$, then $\lambda x_1 \ldots \lambda x_n[p]$ is its abstract or lambda transform.

The ontological significance of abstraction is that some of the terms it produces designate complex propositional properties. From the proposition $(\exists x)((Fx \,\&\, Gx) \supset Hx)$ (or its counterpart with a universal quantifier), it is possible to abstract the property $\lambda x[(Fx \,\&\, Gx) \supset Hx]$. Unlike the original expression to which abstraction is applied, the abstract lacks truth value, but designates a property, specifically the complex 'propositional' property an object has of being *H if* it is both *F and G*. On standard realist semantics, this adds to the ontology of any theory already containing properties F, G, and H, infinitely many additional existent or subsistent properties, one for each abstract derived from each propositional combination of predicate sentences involving F, G, and H.

Standard introduction and elimination principles for abstraction in the simplest (unary) case can be given as truth functional characterizations of the lambda operator.

$$(\forall y)(\lambda x[\ldots x\ldots]y \equiv (\ldots y\ldots))$$

There is also a reduction of abstraction to definite description in higher-order logic.

$$(\forall x)(\lambda y[\ldots y\ldots]x \equiv \iota z[(\forall y)(zy \equiv (\ldots y\ldots))]x)$$

Abstraction is so powerful a mechanism in mathematical logic that it can be used to define paradoxical properties. Consider the self-application of an object to itself in $(\exists x)(xx)$ or its universally quantified counterpart. This symbolizes the assertion that object x holds or is true of itself, as when the property *being a property* is predicated of being a property. Abstraction makes it possible from this proposition to define the property, $\lambda x[xx]$. The internally negated form $(\exists x)\sim(xx)$ symbolizes the existential assertion that object x does not hold or is not true of x, that there is something which does not hold of itself (as when the property being blue is denied of the property being blue). From this we abstract the property $\lambda x[\sim(xx)]$. By abbreviation, if $Z = \lambda x[\sim(xx)]$, then by bivalence, ZZ is either true or false. Yet it is easy to show by the abstraction elimination rule that $ZZ \equiv \sim(ZZ)$.

To avoid this paradox, simple type theory with its ontology of infinitely ascending orders of legitimate totalities and object types, and corresponding syntax combination restrictions against self- and self-non-applications, is standardly invoked, as in Bertrand Russell and A. N. Whitehead's *Principia Mathematica*. The strategy is to outlaw self-applications and self-non-applications as ill-formed in order to avoid a comparable paradox involving relation abstraction, limiting predications of objects of any type n to predicates of order type $n+1$, to prevent logical inconsistency.

Applications of abstraction include definition of recursive methods and formal statements of Church's Thesis in computing theory, construction of intensional logics and semantics, and the concise formulation and investigation of logical paradoxes.

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DALE JACQUETTE

Lambert, Johann Heinrich

Johann Heinrich Lambert was born in Mulhouse/Alsace in 1728 and died in Berlin in 1777. He is known especially as a mathematician, natural scientist, and philosopher. His philosophical efforts culminated in two main works: *Neues Organon oder Gedanken über die Erforschung und Bezeichnung des Wahren und dessen Unterscheidung von Irrthum und Schein* (1764) and *Anlage zur Architectonic, oder Theorie des Einfachen und des Ersten in der philosophischen und mathematischen Erkenntnis* (1771).

In the *Organon* Lambert develops a comprehensive epistemology and philosophy of science, reacting critically to Euclid, René Descartes, Nicolas Malebranche, John Locke, and Christian Wolff. The first part, the "Dianoiologie", deals with concepts and with their composition in judgements and questions; it contains a "Linienkalkül" for the representation of syllogistic conclusions and distinguishes scientific knowledge from everyday knowledge. The second part, the "Alethiologie" offers a solution to the problem of how knowledge can begin: the truth of propositions is, he argues, founded in the end on the correctness of the fundamental concepts. Lambert here defends also a conception of truth which can be characterized as a variant of the coherence theory. The third part, the "Semiotic", investigates signs especially in respect of their function of communicating truth. In the last part, the "Phenomenologie", Lambert places the realm of appearance between those of the true and the false and points out ways to bring about its removal.

Lambert's metaphysics is drawn from his *Architectonic*. He provides in the *Organon* the methodological tools for the whole practice of knowledge, and the *Architectonic* may be seen as an important application of these tools. The latter falls into four parts. The first, or "General conception of the basic doctrine", is to be read as a preamble which gives a historical background and programmatically establishes and organizes the disciplines of metaphysics. "Ontology" or "Theory of the thing as such" is just a subdiscipline of the *Architectonic*. The second part, "The ideal of the basic doctrine", refers to "our conception of the things . . ., where the ideal is to be seen in relation to the things themselves" (§ 161). In the third part Lambert seeks to establish what he calls "the real of the basic doctrine". In the last part, "The quantity", he discusses the quantitative order of things and this part is thus to be set against the former parts, which deal with qualities.

Lambert's general attitude to contemporary metaphysics is comparable with that of Kant in that he takes an extremely sceptical point of view: of course, one knows, in metaphysics,

> that there is nothing which can be found in nothing, but one does not always know which object one really wants to look for, and even more rarely does one know from where one could find it or where one is to search for it (*Architectonic*, § 565).

However, Lambert does not draw from this pessimistic diagnosis the conclusion that the metaphysical project is impracticable on principle. Lambert himself considers his own contribution to metaphysics to be a *preliminary collecting of material*, an "*ontological lexicon*", "always useful to consult" (*Architectonic*, Vorrede, viii).

The originality of Lambert has at least two aspects. First, he does not follow the usual organization of metaphysics with the division into *metaphysica generalis* and *metaphysica specialis*, though he does mention matters of the *metaphysica generalis* in the second and third part of the *Architectonic*. Second, he adopts in his metaphysics a critical approach to language, both as concerns definitions and as concerns the use of metaphysical terms.

A contemporary influence of Lambert's philosophical work and particularly of his *Architectonic*, apart from that on Kant and Moses Mendelssohn, is difficult to trace. The current interest in the *Architectonic* rests on at least three aspects. First, because of its character as a lexicon, the *Architectonic* offers a fund of information about the development of the use and the definition of metaphysical terms which has been scarcely noticed by the historiography of metaphysics; here one can mention especially his explanations concerning form and matter. Second,

we can now see, by referring to Lambert's systematology, that the *Architectonic* contains lessons of outstanding originality. Third, explanations useful to current debates can be taken from the *Architectonic*: consider above all the explanations of the problems of identity and continuity provided by Lambert in the fourth to sixth main parts of the *Architectonic*.

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GEO SIEGWART

Language I: Propositions and Truth

Although one finds philosophers who are concerned with language as far back as the ancients, perhaps the clearest treatment of the ontological issues underlying our use of language begins with the work of the early 20th-century realists. As it developed in Britain, realism at the turn of the century was, in part, a reaction to the neo-Hegelian idealism of T. H. Green (1836–82), F. H. Bradley (1846–1924), and others. Proponents of this realism included John Cook Wilson (1849–1915) and his followers at Oxford and G. E. Moore (1873–1958) and Bertrand Russell (1872–1970) at Cambridge.

Moore's criticism of the idealist position included a criticism of the view that judgement is an operation performed on ideas, images, or other subjective mental entities. For Moore (*Mind*, 1899), the objects of judgement – expressible in language in a subject-predicate form – are abstract propositions to which the thinking subject stands in an intentional relation. (These propositions are abstract in that they are typically held by their proponents not to be located in space or time.)

Propositions. Thus, we see one of the two main reasons given to acknowledge the ontological status of propositions: propositions are to be understood as the objects of certain mental acts (cf. Ryle 1929–30). If one holds (following the early Franz Brentano) that conscious mental acts stand in intentional relations to objects, one may also choose to hold, more specifically, that those acts whose content is expressible by a complete sentence or independent clause (for example, 'I believe, "It is raining"', or 'I believe that it is raining') take as their object a proposition. This is especially attractive once one realizes that an act of believing or a believing subject could not stand in an intentional relation to the corresponding fact or state of affairs – at least not in the case of false belief. (In the case of false belief, there are no corresponding facts.)

The other of the two main reasons given for acknowledging the ontological status of propositions is more straightforwardly concerned with the nature of language. Here, it is claimed that propositions are needed as the meanings of sentences. Proponents of this position argue that different sentences – different types, not just different tokens of the same type – can mean the same thing.

The English sentence, 'The book is red', and the German sentence, '*Das Buch ist rot*', both have the same meaning. Yet, the symbols employed in stating each sentence differ. Hence, it is argued, the meanings of the sentences cannot be identified with the particular form of words used, as a nominalist may wish to do.

An obvious alternative would be to hold that different sentences have the same meaning in virtue of their both describing the same fact or state of affairs. But, even apart from the concern that there are no facts which exist or obtain when the sentences are false, there is a further reason, it is argued, to distinguish the meaning of a sentence from the fact or state of affairs it describes. In certain linguistic contexts (so-called oblique contexts) sentences that describe the same state of affairs may not be interchangeable *salva veritate* – as one would assume they should be, if, in virtue of describing the same state of affairs, they had the same meaning.

It is interesting to note that the two above-mentioned examples used in arguing for the ontological status of propositions understood as the meanings of sentences appear to be incompatible. It seems plausible to say, in the first case, that the English sentence and the German sentence mean the same thing. However, in the second case, it is just such sentences which – though they may describe the same state of affairs – would not be interchangeable in all belief contexts. Specifically, they would not be interchangeable in those belief contexts in which the subject did not know both languages.

Concepts and Conceptualization. Various phenomena surrounding language use suggest other issues of underlying ontology. One issue is the extent to which competent language use presupposes concepts and, if so, how they are to be understood ontologically. H. H. Price (1899–1985) has noted that using a language seems to presuppose having certain concepts – understood, by Price, to be manifested primarily as recognitional capacities.

He says:

> If I am to speak or listen understandingly, to write or to read, I have to *recognize* the sounds or black marks as being the words they are. I have to recognize this visible mark or noise as a sensible 'token' of a certain 'type'-word. Otherwise it will not function for me as a word at all; it will be just a curious sound or mark and nothing more (Price, 1969, p. 38).

Yet, it would also seem that some concepts in turn presuppose language, in the form of a theory. Abstract theoretical concepts, such as those of physics, may be impossible to acquire apart from understanding a theory which is expressed symbolically. It is not clear what it would be, for example, to have a concept of a quark and not have that concept embedded in the language of a theory of physics.

But now the question arises as to whether the cultural and historical accidents that shape a society's language (broadly construed) may not influence the members' very understanding of the world. A philosophical example of this would be the question of the influence of certain developments in logic on the development of other branches of philosophy in the early 20th-century analytic tradition. Thus, the development of the predicate calculus may be seen to have influenced the way in which the logical atomists construed the structure of reality (cf. Urmson 1956).

Concerns such as these have led certain recent philosophers – the so-called irrealists – to argue that we may not be able to make sense of the world's having any particular characteristics, independently of the imposition of some theory-laden conceptual scheme. And, thus, for someone such as Nelson Goodman, there may be any number of adequate ways to understand the world:

> There are very many different equally true descriptions of the world . . . And when we say of them that they all involve conventionalizations, we are saying that no one of these different descriptions is *exclusively* true, since the others are also true. None of them tells us *the* way the world is, but each of them tells us *a* way the world is (Goodman 1972, pp. 30–1).

Irrealism. One can find similar irrealist themes – though not used for explicitly irrealist purposes – in the works of W. V. O. Quine (e.g. 1969). According to Quine's thesis of 'ontological relativity', the ontological import of a theory can only be determined relative to some other meta-theory or background language whose ontic commitments are then taken at face value. If one also accepts a Tarskian understanding of the truth of a theory in terms of satisfaction – that is, in terms of a mapping of the relevant components of the sentences of the theory on to the world, on to a domain of objects, as specified by another theory or interpretation in some meta-language – then it looks as if the notion of truth becomes relativized as well.

Indeed, Hilary Putnam (1983) has an irrealist argument which suggests that, if truth is understood in terms of satisfaction, the claim that a true theory describes some *one* way the world is no longer makes sense. Putnam's argument might be called the model-theoretic argument for irrealism. The argument involves an application of the Löwenheim-Skolem Theorem (or the related Gödel Completeness Theorem) to a given theory of 'the world'.

The basic form of the argument is as follows: assume T_1 is the formalization of an

ideal theory. Since at the very least this means it must be consistent, it follows from the Gödel Completeness Theorem (in its model-theoretic form) that T_1 has models.

Now, pick a model, M, and map the individuals of M one-to-one on to pieces of 'the world'. The result is a satisfaction relation – a correspondence between the terms of the language of our theory and sets of pieces of the world – such that T_1 comes out *true*, so long as truth is understood in terms of satisfaction.

Yet, there is a problem for the metaphysical realist. The realist wants to make sense of a true theory's describing *the* way the world is. For example, the realist wants a true theory interpreted in such a way that the term 'dog' in the theory picks out dogs and only dogs in the world.

But nowhere in Putnam's application of the Löwenheim-Skolem results is anything said about the relevant interpretation's mapping the terms of the language of the theory on to the world in *the right way*. And this is precisely the irrealist point of Putnam's argument: once truth is construed as satisfaction, one can no longer make sense of the *intended* interpretation of a true theory in any absolute fashion.

The most one can do is to define the intended interpretation of a theory relative to another theory, a meta-theory, in the language of which the 'correct' interpretation is specified. But now one has merely returned to Quine's thesis of ontological relativity. The metaphysical realist finds no solace here; the possibility of an unproblematic ontological assay of the world – of getting at the way the world *really* is – is still thwarted.

Is the realist not helped by the move to naturalism? For example, could one not understand the connection between the terms of a true theory and the relevant things in the world to be causal – that is, can one not avoid irrealism by embracing a causal theory of reference? No, says Putnam, for similar problems arise concerning the causal theory of reference itself. We can make no more sense of the intended interpretation of this theory than of any other; we are as little able to understand the term 'cause' to have a unique reference as we are to understand the term 'dog' to refer to dogs and only to dogs, independently of some further theory.

Conclusion. Whether or not one thinks that the irrealist position is tenable, it is particularly interesting to notice the role that language has come to play within the irrealists' arguments. Those with irrealist tendencies typically deny the possibility of direct cognitive access to the world, at least in any interesting sense. All significant thought then becomes inherently tied to complex conceptual schemes which are (primarily) embedded in language.

Rather than being trapped behind the veil of appearance, we have become lost in the labyrinth of language. Thus, it seems that language (in lieu of ideas) has become the vehicle for a new kind of representationalism. That various kinds of scepticism follow, the irrealists are quick to point out.

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D. E. BRADSHAW

Language II: Linguistic Structure

The Revival of Linguistic Analysis. It is as common, nowadays, to speak of 'the structure of a language' as it was with linguists of an earlier generation to speak of 'the life of a language'. Throughout the 19th century and

well into the 20th, linguists were preoccupied with historical research: tracing the ancestries of languages and establishing family relationships amongst them. This study, comparative philology, abundantly justified by its success, is far from exhausted. But the most important new ideas of more recent linguistic studies are not in this field; they are to be found in the analysis of 'acts of speech' (utterances) – the kind of analysis that provides us with the description of those changeable social institutions that we call 'languages'.

Modern linguistic analysis (inaugurated by Ferdinand de Saussure's (1857–1913) *Cours de Linguistique Générale*, 1916) is, in fact, the revival of an ancient discipline. It had been more or less dormant since Priscian's (6th century AD) *Institutiones grammaticae* (*c.* 500). The reasons for the long suspension of original analytic studies of languages seem to be mainly

1. the prestige of the ancient descriptions of Greek and Latin; and
2. a firmly entrenched dualist interpretation of 'meaningful expression', which would assign the systematic study of such expressions to two separate non-linguistic disciplines: the study of 'expressions' to physics or physiology, and the study of 'meanings' to philosophy or logic and later to psychology (cf. H. Paul 1920, 15).

But philosophers and psychologists would in the end reciprocate by asking, in turn, for linguistic investigations; the meaning of an expression, they would say, was to be found in its uses, in the functions it satisfies, amongst other expressions and amongst things and persons. And as regards the study of expressions, the phonetician's advances in the physical (acoustic) or physiological (articulatory) description of them would only lead to complaints that the description of languages was being "swamped" (Edward Sapir 1921, p. 58) "with details which in themselves had no value" (Saussure, *Cours*, p. 77). Without selective criteria of relevance, "the flow of speech" presented itself as "a continuum capable of being divided into any number of parts, all of them equally important" (Trubetzkoy 1939, p. 16).

Contrastive Substitution. The linguistic analysis of utterances – that is, the description of them as regular constructions out of recurrent elements – was in need of its own criteria – criteria for selecting, from meaningful utterances (Saussure called them 'signs', L. Bloomfield, 1933, 'linguistic forms'), just such parts as were relevant for the description of regular constructions. That selection was found to be the work of one basic analytic operation – '*contrastive substitution*'. The parts it selects from a given 'sign' are 'constituent' parts, the replacement of which by others yields different signs of the same type. (In analogous logical terminology, the substituends are the arguments for resultant total expressions which are different values of one and the same function.) Parts that are capable of contrastive substitution (or, indeed, of contrastive deletion) are said to be '*distinctive*' (to have 'diacritical power'). This is what Saussure meant when he characterized anything that is relevant in a language as mainly '*négatif*', '*différentiel*', '*oppositif*'.

Analysis would begin with the intuitive recognition of a sentence of one type or another (statement or question or command etc.) and establish a hierarchy of constituent constructions, down to minimal meaningful elements. The constituent parts, then, that are selected in what A. Martinet (1960) calls '*la première articulation*' are, in fact, not *merely* distinctive; they are traditionally supposed to be intuitively recognized as 'meaningful'. Minimal meaningful elements, of which there may be thousands are themselves, analysable in what Martinet calls '*la deuxième articulation*'; they are regular constructions from distinctive parts – ultimately, from a few dozen 'phonological' elements, which no longer have any meanings in themselves.

The substitutability or deletability of a constituent part of a construction places it at once in two kinds of 'structural' relation:

1. 'syntagmatic' relations to co-occurrent parts, and
2. 'paradigmatic' relations to substitutables (to members of the same 'category').

Syntagmatic relations exhibit the combinatorial constraints to which we submit in speaking a language; paradigmatic relations exhibit the freedom of choice we have within those constraints.

The structural constraints of constructions are frequently indicated by some of their elements. Such formal elements ('markers', 'structure signals') determine and mark particular kinds of construction – as, for example, the *-ness* of *happiness* marks the word as a 'noun' constructed with an 'adjective', or the *to* of *want to speak* marks the whole expression as a 'verbal phrase'. Formal elements may, but need not, be distinctive. English prepositions and conjunctions are (as are the formal constants ('logical words') of artificial logical languages); while *to* of *want to speak* or a fixed word-accent is not. A marker's relevance is secondary, not in the sense that it is less important than distinctiveness for the constitution of sentences, but in the sense that it belongs to elements by virtue of the fact that they operate upon, and therefore presuppose, distinctive parts.

Context and Social Situation. In picking out what is relevant for the structural constitution of a sentence, nothing is excluded as absolutely irrelevant. Thus, while some parts or properties of utterances may appear to be freely variant within the frame of sentences (e.g. some word-order or sentential intonation), these may be picked out as informative (even distinctive or meaningful or a marker) within more comprehensive units of utterance or 'text', or in the 'context' of some special social situations.

Extensions of linguistic investigations beyond the structural analysis of sentences – as, from the very beginning, in the studies of J. R. Firth (1890–1960) and throughout the work of the Prague Linguistic Circle, especially in R. Jakobson's (1896–1982) contributions – are frequently operating with a *teleological* notion of 'function'. This can accommodate the structural part-whole notion simply by interpreting the distinctive parts of a sentence as means to the end of its construction. But an extension of linguistic *structure* to more comprehensive analysanda, to 'texts' of varying types and sizes, and to contexts of situations (as is sometimes aimed at in more recent 'stylistic', 'text-linguistic', and 'pragmatic' studies), can only succeed to the extent to which the analysanda can be identified as determinate kinds of objects, as determinate values of a determinate function.

Semantic Presuppositions. The semantic presuppositions of phonological and grammatical descriptions have been the subject of much controversy.

L. Hjelmslev (1899–1965), in his *Prolegomena to a Theory of Language* (1943), interprets the basic operation of contrastive substitution as a twofold substitution ('commutation'): a 'mutation' of 'expressions' correlated with a 'mutation' of meanings ('contents'). This ontological separation of meaning-entities from expressions exposes the description of unitary signs to all the traditional problems of a dualist metaphysics.

In order to escape from these problems, American schools of 'structuralism' tried entirely to exclude considerations of meaning. Their analytic operations of substitution apply, not to meaningful functions, but to mere 'stretches of speech'. Substitutions are therefore not controlled by the requirement of having to yield and distinguish meaningful expressions. The criterion of functional relevance, the diacritical power of parts, was to be dispensed with; a substitution-class was just a collection of what, in a given corpus, was found to occur in the same 'environment'. Functional relations, between elements that satisfy one and the same function, were replaced by purely 'distributional' relations, simply between elements that are found to co-occur. The aim was to show:

> how each language can be described . . . in terms of the occurrence of parts (ultimately sounds) relative to other parts, and how this description is complete without intrusion of other features such as . . . meaning (Z. S. Harris 1954, p. 33).

The analytic operations, which yield the description of a language, should then, in principle at any rate, be capable of being performed mechanically, thereby preventing any intrusion of semantic intuitions.

This programme proved to be incapable of consistent execution. But work stimulated by it (especially by Z. S. Harris 1951) yielded a

clearer understanding of what exactly it is, beyond the distribution of parts, that is required for the description of a language. Nothing more, in fact, than the assumption that we are able to recognize sentences, of one type or another, and differences of form (expression) and meaning between them. (On deriving constituent meaningful elements, see W. Haas, 1987). This assumption does not imply either a mentalist or a behaviourist metaphysics. To be explicit about the expression ('*le signifiant*') of a meaningful expression ('*un signe*') is to *analyse* it, into the distinctive parts of which it is a function; to be explicit about its meaning ('*le signifié*') is to *locate* it, as itself a distinctive part of more comprehensive functions. What we are referring to throughout is acts of speech and parts of these – utterances that are heard and remembered, amongst other utterances and amongst persons and things. It is not for the linguist to offer a metaphysical exploration of those facts; but his work, like that of any science, might offer suggestions for such an exploration.

Some linguists, however, having had to accept that "a linguistic theory should not be expected to provide mechanical procedures for the discovery of grammars" (Chomsky 1957, p. 55), decided, in their disappointment, to abandon linguistic analysis and to adopt new goals of linguistic theory. Linguistic theory, under the new dispensation, will no longer attempt to inform and direct phonological and grammatical analysis – in the way, in which, for instance, a theory of chemical compounds informs and directs chemical analysis; Noam Chomsky's 'generative-transformational' grammar is designed to *supervene* upon the linguist's descriptive work. "The question how one might have arrived at the grammar" which is to be dealt with by the newly formulated programme of research is "not relevant" (op. cit., p. 56).

First (Chomsky 1957), the attempt was made to provide a mechanical procedure of *evaluation* for given grammars. Later (Chomsky 1965), when it was found that such evaluation procedures could not be relied upon to yield interesting results, the principal goal of 'linguistic theory' was to add something more substantial, by providing a *supplement* to more or less traditional grammars – the supplement of speculative 'deeper' structures which, by their transformational association, would cure the inadequacies of current analyses. A grammar so enriched and deepened – a revival, in fact, of medieval speculative grammar (cf. V. Salmon 1969) – is to give us access not only to the 'tacit knowledge' a speaker has of his language but also to 'innate knowledge' he has of the universal structural principles of language in general. Linguistic theory, then, is to be absorbed once more by psychology – 'cognitive psychology'.

Some twenty years of transformational studies have resulted in rival proposals of a large number of different deep structures for almost every single sentence. This *embarras de richesse* is not surprising. Deep structures are designed, ultimately, to represent general semantic properties of sentences; and the 'surfacy' syntactic structure of a sentence is receptive of a great variety of senses.

In order to decide between competing deep structures, some linguists would turn to that old companion of grammatical studies – to logic, especially to one or another of the more recently developed 'logical languages'. The result was again instructive, though disappointing. The more rigorous logical systems (such as Russell–Whitehead's *Principia* or Stanisław Leśniewski's system, as adapted for general linguistic use by Kazimierz Ajdukiewicz, 1890–1963) are found to impose inappropriate semantic restrictions on the ordinary use of language. But any attempt to extend and relax the rules of a strict logical language – by making logic intensional, modal, pragmatic, natural – could only return us to that multiplicity of rival deep structures from which we had been trying to escape. The logical use of language imposes certain semantic restrictions – restrictions of a logical grammar – on the syntactic constructions of ordinary language; but these restrictions are not part of the grammatical constraints of ordinary language (cf. Haas 1973).

Most linguists (in the United States as elsewhere) have been continuing with the task of extracting the structure of a language by an empirical analysis of utterances, and of

formulating general principles to support that analysis. The 'anti-mentalist' experimentation and the 'generative-transformational' speculation of the last fifty years have given them no reason for changing their occupation; but they will acknowledge a debt to both. Much that has been offered as 'a substitute' for intuitions of meaning can be developed into a verifiable statement of such intuitions. And the generative formalization of grammars has often revealed hidden inadequacies of traditional grammars and raised significant questions, even if those who raised the questions have abandoned the discipline which alone is able to answer them. Some eighty years ago, Otto Jespersen (1860–1943) had to remind his generation that, ultimately, what they had to refer to when speaking of the life of a language, could only be the several lives of speakers and listeners. Today, we shall have to take particular care not to forget, that when we speak of the structure of language, there is nothing else for us to refer to than acts of speech. Linguistic structure is basically a property of utterances, and more especially of those units of utterance that we recognize as sentences.

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Law

There is no coherent or definable body of literature on the metaphysical aspects of law, and readers coming new to this subject may be surprised by the disparities and inconsistencies with which it is infected. This can be illustrated by considering various jurisprudential movements which have, in one way or another, been characterized as 'metaphysical'.

Pragmatism. In the United States, the metaphysical tendency in law is regarded primarily to be an offspring of the pragmatist movement, as founded by Charles Sanders Peirce (1839–1914). Peirce himself began, but never completed, a book on the pragmatist philosophy of law (Krois 1981), and the task of conceiving of legal doctrine along pragmatist lines was eventually to be undertaken by Oliver Wendell Holmes Jun. (1841–1935). Holmes was inspired especially by the pragmatists' emphasis on prediction as the most effective means of verification (Fisch 1942). The following quotation exemplifies his pragmatist jurisprudence:

> The primary rights and duties with which jurisprudence busies itself . . . are nothing but prophesies . . . [A] legal duty so called is nothing but a prediction that if a man does or omits certain things he will be made to suffer in this or that way by judgement of the court; – and so of a legal right (*Harvard Law Review*, 1897, p. 458).

Similarities can be detected between Holmes's writings and those of Rudolf von Ihering (1818–92). Thus Holmes's statement in *The Common Law* (1881) that "The life of the law has not been logic; it has been experience" is generally taken to epitomize his *sui generis* pragmatist jurisprudence. Yet, only a few years earlier, in *Der Kampf ums Recht* (1872), von Ihering had stated in a remarkably similar vein that "The life of the law is

struggle, a struggle of nations, of state power, of social estates, of individuals".

Kelsen's Pure Theory of Law. In the European, as opposed to the Anglo-American, tradition, the idea of a metaphysics of law is more solidly entrenched in jurisprudential thinking. This metaphysical tendency tends to be traced back to Kant and in legal philosophy it is exemplified by the prodigious literature associated with Hans Kelsen (1881–1973). Many scholars assert that Kelsen himself was very much a Kantian. Kelsen is concerned to present a 'pure' theory of law, that is a theory which conceives law in terms of its 'typical structure' (1968, p. 611), wholly "independent of the changing content which it exhibits at different times and among different peoples" (1957, p. 266). Moreover, he presents the idea of a legal order as an aggregate of norms, lower (more concrete) norms deriving their validity from higher (more abstract) norms. At the foundation of this normative structure, Kelsen insists, there subsists a 'basic norm' (*Grundnorm*). As he explains in *General Theory of Law and State* (1961), the basic norm is the 'transcendental-logical presupposition' which is necessary to the existence of any legal order. That is, in Kantian terms, it is 'objectively valid':

> because it is presupposed to be valid; and it is presupposed to be valid because without this presupposition no human act could be interpreted as a legal, especially as a norm-creating, act (p. 116).

Hence Kelsen's metaphysics boils down to the necessity of presupposing the objectivity of the basic norm.

A valid legal norm, for Kelsen, is *the meaning of an act of will*. More precisely, it is the product of what law-makers, informed by public opinion, believe should be law. The basic norm, in contrast, is not the creation of any mundane body of law-makers. Therefore it cannot emerge from some subjective act of will. Rather, it is the product of what, in the *Pure Theory of Law* (1967), Kelsen calls an *act of thinking*. That is, the basic norm emanates from a collective act of thinking whereby citizens recognize that they ought to obey the commands of the historically first constitution.

There are two general objections to the Kelsenian concept of the basic norm. First, Kelsen's theory presupposes that a valid legal order will of necessity derive from a valid original constitution. Yet it will not always be the case that the authors of the original constitution are morally and politically entitled to lay it down. In Britain, for example, the 'original constitution' was made by William of Orange (1650–1702) who did not have a good claim to the throne and whose parliament was not a lawful parliament.

Second, Kelsen concedes that the basic norm, as conceived by the original constitution-makers, must be associated with some particular act of will on their part. Yet, on this concession, his theory begs the question as to how the basic norm of any legal order can itself be valid: the basic norm must, after all, be the meaning of an act of will which is itself authorized and informed by some higher level of normativity. What is this meta-normativity which inspires and authorizes the founding of the basic norm? Kelsen was ultimately to acknowledge that his concept of the basic norm is simply a product of the imagination: "the assumption of a basic norm", he conceded in 1964:

> not only contradicts reality, since no such norm exists as the meaning of an actual act of will, but also contains contradiction within itself, since it represents the authorization of a supreme moral or legal authority, and hence it issues from an authority lying beyond that authority, even though the further authority is merely figmentary (Tur and Twining 1986, p. 117).

The Phenomenology of Law. One tendency among Kelsen's following has tried to re-articulate his pure theory in terms of some broadly (indeed, sometimes erroneously) conceived notion of Husserlian phenomenology. In the early 1920s, Felix Kaufmann (1895–1949) and Fritz Schreier each attempted to present the pure theory in Husserlian as opposed to Kantian terms. This task was also undertaken during the middle part of this century by various Latin-American legal philosophers, the most notable of whom were Carlos Cossio and Luis Recaséns Siches. For Cossio, the normativity of law is founded upon and validated by intersubjective human conduct rather than any specific constitution-

founding basic norm. Recaséns Siches, in contrast, regards the basic norm as indispensable to any properly scientific theory of law. However, where Kelsen tried generally to avoid defining the basic norm in anything but the most abstract of terms, Recaséns Siches conceives of the basic norm in a very specific, Hobbesian sense, as the need for *security*:

> the basic motivation which determined the origin of Law is not derived from the high regions of the superior ethical values, but from a value of a lower rank, namely, from the *security* of social life . . . Law was not born into human life by reason of the desire to render tribute or homage to the ideal of justice, but to fulfil an inescapable urgency for security and certainty in social life (1948, pp. 118–19).

A more plausible phenomenology of law is that developed by Adolf Reinach (1883–1917). In *Die apriorischen Grundlagen des bürgerlichen Rechts*, first published in 1913, Reinach presents the thesis that foundational to law there exists a determinately structured family of essences standing in *a priori* relations to each other. Reinach demonstrates this thesis particularly well by way of his discussion of promising as a *social act*: the act of promising, he explains, gives rise of necessity to a claim and an obligation so that an obligatory relationship arises between claimant and obliged. That this is so is a matter wholly independent of the existence of any particular positive laws. Nevertheless, even though the *a priori* social act of promising subsists separate from and irrespective of positive laws, such laws themselves, in so far as they create rights and duties, require foundation within that very social act.

Reinach makes similar claims concerning the ideas of property and person. Every legal concept of property – that is, property conceived as a *right* – requires foundation within the idea of property as an *a priori* pre-legal phenomenon, a certain relation between person and thing. Furthermore, laws can only come into existence due to the fundamental legal capacity of the person; that is, there is about the person an *a priori* capacity which serves as the foundation for all social and legal relationships.

Reinach concedes that positive laws are not mere instantiated reflections of their *a priori* foundations. Nevertheless, he does insist that there is a degree of *ontological bindingness* about these foundations which ensures that the creation of positive laws must accord with the *a priori* structures and relations by which they obtain. It is possible to envisage that an *a priori* structure might actually dictate the concrete character of a positive legal provision in such a way that, if this provision were created in a manner which contravened its *a priori* structure, it would be invalid, unjust or absurd. If, for example, a law was created stipulating that a promisee has an obligation to fulfil the content or action of the promisor's promise, while the promisor has a right against the promisee to claim such fulfilment, the outcome would be an absurdity, since it would mean that X could make a promise to Y, and Y would thereby be found to fulfil the terms of X's promise. This contradicts entirely what we understand intuitively to be the essential structure of promising.

The merit of Reinach's jurisprudence is that it demonstrates, first, that the foundation of law is characterized not by a singular, foundational 'essence', but by a plurality of interrelated and intuitively intelligible essences; and, second, that any inquiry into the metaphysical aspects of law must focus not only on the positive law but also on the *a priori* pre-legal domain within which all positive law is founded.

In recent years, legal semioticians – focusing specifically on the 'deep structures' immanent in the legal system – have tended increasingly to emphasize the ontological dimensions of legal concepts and formations in a manner not wholly divorced from that of Reinach's realist ontology. Though not claiming any specific indebtedness to the work of Reinach, some legal semioticians acknowledge possible overlaps between their own general project and that of Husserlian phenomenological jurisprudence (Jackson 1985).

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NEIL DUXBURY

Leibniz, G. W.

Gottfried Wilhelm Leibniz was born in Leipzig in 1646 and died in Hanover in 1716. He is the most important philosopher of 17th-century rationalism. Leibniz was a thinker who was well informed about almost all scientific developments of his time, corresponded with almost every important contemporary scientist and philosopher, and himself wrote on a wide range of different topics. He studied philosophy in Leipzig and Jena with Erhard Weigel (1625–99), Johann Adam Scherzer (1628–83), and Jakob Thomasius (1622–84) and law in Altdorf near Nuremberg. He held court appointments during his whole life and never became a professor of philosophy – a fate he shared with other rationalists such as René Descartes and Spinoza. Thus he also never taught philosophy.

Leibniz wrote on philosophy, theology, mathematics, physics, linguistics, etymology, genealogy, history, politics, medicine, and economy, and he was in all these disciplines influential, in some of them creative and even pioneering. Because of his creativity, and his capacities in analytic and synthetic thinking, he is rightly called the 'Aristotle of the *Neuzeit*'. He was a restless thinker, and his ideas were often so new and original that many of them were not understood at the time. The scientific community had to wait until the 20th century to gain a better understanding of his achievements and importance.

Leibniz also had an excellent knowledge of the history of philosophy. He translated Plato and he read Aristotle and the Scholastics in the original. He wrote in Latin, using post-medieval scholastic Latin, and in French. The scholastic background of his thought means that he can be characterized as the most important partisan of German Protestant Scholasticism, a movement which in Leibniz's day was dominated by Aristotelianism.

During a stay in Paris from 1672 to 1676, Leibniz was influenced also by Cartesianism. He later criticized this philosophy, but was never able to rid himself completely of certain basic Cartesian doctrines, for example the doctrine of innate ideas, the root of which Leibniz himself saw already in Plato's *Meno*. His metaphysical system might thus be characterized as a synthesis of Platonism, Aristotelianism, and Cartesianism.

Leibniz is something of a Janus figure, with one face looking to the past and the other to the future, and in order to understand his ideas, we have to look in both directions.

Metaphysics and Ontology. Leibniz was a metaphysician from the beginning and his first publication was on metaphysics. He wrote in 1662 a dissertation on the principle of individuation in which he discussed the relevant theories of the Scotists and other post-medieval scholastic philosophers. Later, in 1686, he published his *Discours de Métaphysique*, after Suárez's *Disputationes Metaphysicae* the most important work in metaphysics in the first period of the *Neuzeit*. In 1714 he wrote his final work on metaphysics, the famous *Monadology*, in which he gives in ninety paragraphs a distillation of his mature metaphysical system – a system still awaiting an adequate interpretative treatment in the philosophical literature. Other writings of importance in this connection are the correspondences with Burcher De Volder (1643–1709) and Bartholomaeus Des Bosses (1688–1738) from 1702 to 1708, together with his earlier exchange of letters with Antoine Arnauld (1612–94) between 1686 and 1690.

Leibniz also employs the term 'ontology', by which he understands the science of

something and nothing, of being and not-being, of the thing and its modes, of substance and accident.

Metaphysics and ontology he distinguishes by their methods and by their objects. Metaphysics or *metaphysica specialis* has to do with God and is identified with *theologia naturalis*. Its method has to be deductive, because we do not have any experience of God. This method Leibniz also calls the *ars inveniendi* or art of invention. Ontology is *metaphysica generalis* and has as its object the most general features of the world, i.e. substances and their attributes. The method of ontology is descriptive, because we can have an experience of its objects. This descriptive or even phenomenological method is however to be supported by logical analysis.

Leibniz's metaphysics is marked by two principles. The first is the principle of non-contradiction, which generates the *realitas essentialis*: in logic and mathematics non-contradictory entities automatically exist. Metaphysics uses in addition the principle of sufficient reason, by which we can explain why something exists rather than not. This principle is valid in the realm of contingency or of the *realitas existentialis*. Metaphysics has to do with both kinds of reality.

Ontology and metaphysics deal with four relations:

1. the inherence of accidents in their substance,
2. the relation of part to whole (mereology),
3. the relation of cause and effect,
4. the relation of means and end (teleology).

By applying these four relations to Leibniz's metaphysics, we can try to understand his ideas. Generally, we have to speak of metaphysics, because God, his thinking, and his action are omnipresent in Leibniz's writings, and, as content of God's thinking, so also are the possible worlds. Thus in Leibniz's philosophy we never have to do with pure ontology, but always with metaphysics.

Monads or Individual Substances. The most important ingredient of Leibniz's metaphysics is the individual substance or the 'monad', as he calls it in his mature philosophy. Leibniz takes the concept of substance from the Aristotelian tradition, but he develops it in two ways.

First, he introduces the notion of an individual concept. Every individual substance has one and only one individual concept. This concept is complete, i.e. every accident of the substance falls under a part concept of its individual concept; and it is also maximally consistent, i.e. it contains every concept consistent with it.

One consequence is that if someone grasps an individual concept, then he can see at the same time all the past, present, and future attributes of the corresponding individual substance.

A second important feature of the individual substance as Leibniz conceives it is that it has no parts. But it does have accidents of mental qualities and dispositions. Monads as spiritual substances are primitive in relation to the part-whole analysis and very complex in relation to the substance-accident analysis.

Following Aristotle in *De Anima*, Leibniz discriminates two kinds of attributes of monads: perceptions and apperceptions. Perceptions are passive and non-reflexive; they constitute the relation to other monads and their attributes. Apperceptions are active; they are reflexive mental acts like thinking and knowing which are characteristic for human beings, where we have to share perceiving and memory with animals.

There is no causal relation between monads, but only between the different states of a monad. But because every monad is a microcosmos, or a world-apart, each reflects the whole macrocosmos, i.e. every other monad and its attributes, and thus we have a derivative causality in the world.

The fourth or teleological relation, that of means and end, has to do with human action (as also with that of God). Leibniz gives an impressive example in §19 of his *Discours de Métaphysique* how, when we try to describe human actions only in terms of the relation of cause and of effect, the resultant description is evidently absurd.

The Principle of Individuation. Already in his first publication of 1662 Leibniz discusses

the medieval and post-medieval scholastic theories of the principle of individuation. He rejects all these theories: individuation by matter, by form, by negation, and by the Scotistic *haecceitas* which includes all attributes of an individual minus the attributes he shares with each individual of his species (i.e. the essential or necessary attributes). Leibniz accepts only the *entitas tota* as principle of individuation, i.e. all the attributes of an individual – and his view of individuals as unique, non-divisible, non-material entities, individuated by their whole entity, has roots in later Scholasticism, especially in nominalists like Suárez.

In his correspondence with Arnauld he connects his conception with the theory of possible worlds. He speaks of an Adam who is characterized by only four attributes, and he says that this Adam could live in several possible worlds. Leibniz creates by this theory a new genus, namely a general Adam, who could exist in different possible worlds. But in fact this Adam is not a genus but only an incomplete concept of the individual Adam. Incomplete concepts do not belong to a single possible world, only individuals do, and Leibniz stresses further that every property must be present or known in order for that individual to be identified.

Individual Accidents. Some of the arguments in his dissertation of 1662 are based on the existence of individual accidents. Leibniz rejects certain theories of individuation because they are incompatible with the acceptance of individual accidents. He introduces individual accidents, later, too, in his arguments against Samuel Clarke (1675–1729). And he does not think that the individuality of an accident comes from its inherence in an individual substance. For Leibniz inherence is a purely ontological relation between an individual substance and an individual accident; thus it is without any epistemic import.

For Leibniz, then, in contradistinction to many other philosophers, individuality is not restricted to substances; there are also individual accidents or moments – individual events, acts, processes, actions, and situations.

This has consequences for his theory of universals. Leibniz is a nominalist in the sense that he embraces an ontological individualism. The world contains only individuals: substances or accidents. Universals do not really exist. The perceptions and apperceptions of the monads, representing all passive or active properties, these too are individual accidents.

Leibniz also discusses the ontological status of relational accidents like 'father of' or 'son of'. He comes to the conclusion that relations are *entia rationis* or mental entities, but that they have their foundation in reality. Thus the fatherhood of David and the sonship of Solomon have their foundation in a certain action of David. Relations are founded in non-relational individual accidents.

Mereology. Like the tradition before him, Leibniz knows and uses three kinds of whole: essential wholes, integral wholes, and aggregates. In the first case no part is separable, in the second case some parts are separable and some not, and in the third case every part is separable. As examples for essential wholes Leibniz gives geometrical entities like triangles, but also God, angel and soul. As examples for integral wholes he mentions substances like human beings, but also artefacts like machines. As examples for aggregates he generally uses a contingent set of substances.

In a footnote to a letter to Des Bosses, Leibniz applies this tripartite account to substances. He distinguishes first of all between substances and *substantiata*. Simple substances or monads like God and angels have no parts; *substantiata per se* or composed substances have parts; and *substantiata per accidens* or aggregates are pure heaps and nothing else than the sum of their parts.

An essential feature of Leibniz's mereology is his account of hereditary properties, properties which distribute from the whole to its parts, later called by Nelson Goodman 'dissective', and also properties which are hereditary from the parts to the whole, later called 'expansive'. Thus, for example, the property 'to be the best' is not dissective. Even in the best of all possible worlds not every part is the best. There could be a better part in a world which is not the best. The basis

of this analysis is the difference between a quantitative and a qualitative whole. In a quantitative whole, for example the shortest distance between two points, every part is also a shortest distance in its own right. But in a qualitative whole like a beautiful face not every part has to be beautiful. The world, now, is a qualitative whole in Leibniz's eyes.

Another impressive example from the *Monadology* is the hereditariness and non-hereditariness of the attribute 'to be a machine'. The difference between natural and artificial machines consists in Leibniz's eyes in this higher-order attribute. In the case of natural machines every part is a machine: in the case of artificial machines this is not the case.

Conceptual Atomism and Combinatorics. Leibniz was not an atomist, and he argued against the atomists of his time, especially against Pierre Gassendi. Beginning with his *Dissertatio de Arte Combinatoria* from 1666, however, Leibniz was a conceptual atomist, and was correspondingly seeking to establish what were the simplest concepts. In the *Dissertatio* itself he was convinced that there exists a finite number of indivisible concepts, the *termini absolute primi*, of which all the other concepts are composed, and that we can know and identify them. Later he was also convinced that there are really simple and indivisible concepts, but that the number thereof is infinite and we cannot know and identify them. We have to be content with *notiones quoad nos primae*, i.e. with concepts which are not absolutely simple concepts but only simple for us, like the simple qualities of our sense experience: red, blue, bitter, sharp, etc.

Thus for Leibniz the empirical structure of our world is molecular and not atomistic. We have to work with concepts which are not completely analysed.

During his whole life Leibniz employed a combinatoric approach, and it was even he who introduced the term '*combinatio*' for all combinations, conternations, conquaternations, and so on. He conceived the combinatoric art as a part of metaphysics, dealing both with the relation of part to whole (combination) and also with the relation of part to part (permutation).

God. As for other important 17th-century philosophers like René Descartes and Spinoza, so also for Leibniz God is the central object of metaphysics. In his *Theodicy* of 1710 Leibniz discusses three aspects of the *theologia naturalis*: God's attributes or perfections, God's thinking, and God's action.

God's attributes or perfections are essential to and inseparable from their object; they constitute a maximally consistent set and are identical with God's essence. This identity, already discussed by Thomas Aquinas, is of a special sort, because it relates different types, namely substance and attribute. Leibniz uses this identity for his famous proof of God's existence, later also accepted and made more precise by Kurt Gödel.

God's thinking contains an infinity of possible worlds, which he constructs by combining *prima possibilia*, i.e. the first or simple concepts, in different ways. All these worlds are composed of substances and accidents. Only the best of them is realized, i.e. the most perfect composition.

One consequence of this account is that there are non-realized *essentia* or *possibilia*, those belonging to worlds which are not realized. Leibniz holds that all *essentia* have an inclination or tendency to reality. Another consequence is that for Leibniz existence is a predicate: there are things which exist and there are things which do not exist. This he explicitly stresses in the *Nouveaux Essais*. The competition between possible worlds is decided by the principle of the best, i.e. the principle which favours the world best fulfilling the minimax principle, i.e. a world with a minimum of rules or laws and a maximum of states of affairs, or, as Leibniz also puts it, a minimum of causes and a maximum of effects or a minimum of means and a maximum of ends.

Another important philosophical problem is the creation of this world. God creates the best of all possible worlds because of his goodness, and Leibniz stresses that this creation is not dominated by metaphysical, geometrical, or logical necessity but by moral necessity. The difference is that in the former case the contrary is impossible; in the case of moral necessity, however, it is possible but very improbable. God creates the best of all

possible worlds with moral necessity, and one consequence of this is that physical necessity, too, in depending on moral necessity, is not absolute necessity but a very high degree of contingency, i.e. contingency very near or convergent to absolute necessity. Thus the laws of nature for Leibniz, in contradistinction to Descartes, are not necessary but have only a very high degree of probability.

Following this analysis, God's action is not necessary but contingent, the contrary being possible in every case. He is not forced by his nature to create the world as a matter of necessity (as Spinoza thinks); rather, he creates the world following his rationality, and he could have omitted this creation or created another world.

Human action follows God's action in its structure, and Leibniz stresses that a free action has three conditions: no internal constraining, no external constraining, and freedom of choice. Free action is not compatible with necessity; it depends on contingency.

Space and Time. Especially in his correspondence with Clarke, Leibniz presents his theory of space and time. Leibniz was in his time the most powerful adversary of the Barrow–Newton theory of space to the effect that there exists an absolute space into which God has placed the world.

Some odd consequences follow from this theory. The first is that God uses only a part of the space for the world. The second is that he could have created the world before or after its real creation, because space and time exist independently of the world.

Leibniz argues against this conception, holding that space and time are dependent on the things. Space for him is the order of coexistent things, and time the order of successions. Time is dependent on the different states of monads, states connected by causality. Leibniz hereby develops the first causal theory of time, as for example when he wrote: "If one of two states which are not simultaneous, involves a reason for the other, the former is held to be prior, the latter posterior".

Space and time for Leibniz are relational entities, having their foundation in the accidents of things and, as we have seen, Leibniz is convinced that these accidents are individual. Space and time are not pure mental entities, but mental entities with a foundation in reality, i.e. a fundament in individual accidents of substances. Thus space has its foundation in the individual situation of each body, and time has its foundation in the successive states of the monads. Situation is here different from place, because situation is an individual accident which cannot migrate from one corporeal substance to another, where two bodies can occupy successively the same place.

With his theory, Leibniz is able to argue against Newton in a convincing way. There is, first, no rational ground why God uses only a part of the absolute space for his creation. If this were true, God's action would be incompatible with the principle of sufficient reason. Second, the claim that God could have created the world before or after its real creation is absurd, because time comes only together with the things. Every world has its own space and time. Leibniz in his conception of space and time is very near to Aristotle's view and far from either Sir Isaac Newton or Kant.

Modality. Modality has been connected with metaphysics ever since the work of Plato and Aristotle, and indeed the most metaphysical concepts such as potentiality, actuality, possibility, and necessity are modal ones.

Leibniz, in his work on modal philosophy, uses besides basic modalities like possibility, impossibility, necessity, and contingency, also modal concepts like compossibility, inevitability, necessity and impossibility *per accidens*, unchangeability, moral and physical necessity, and so on. Thus he has quite an arsenal of modal concepts for the purposes of metaphysical analysis.

Necessity and impossibility *per accidens*, the principle of plenitude, and future contingents are involved in Leibniz's analysis of different aspects of the relation between reality and time. Diodorus Cronus held that what is possible has to be realized in the past, present or future. Leibniz restricts this *principle of plenitude* to compossible systems such as our own world.

The concept of compossibility – the possibility of one thing in relation to another – Leibniz inherited from the Scholastics.

Among compossible systems are included above all relations between monads or individual substances.

Of the remaining modal notions, moral necessity relates action and reality. Physical necessity together with inevitability relates causality and reality. Strict contingency, or what is not necessary and not impossible, is, following the Aristotelian–scholastic tradition, further subdivided into different probabilities.

This subdivision has for two thousand years formed the basis of a logic or theory of probability.

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HANS BURKHARDT

Leśniewski, Stanisław

Stanisław Leśniewski, the distinguished Polish logician and philosopher, was born in Serpukhov, Russia, on 28 March 1886. He studied philosophy at various German universities and in 1911 received his doctorate on promotion by Kazimierz Twardowski at the Polish University of Lvov. In 1919 he was appointed to the chair of philosophy of mathematics in the newly reopened University of Warsaw. He held the chair until his untimely death on 13 May 1939.

In 1911, while still in Lvov, Leśniewski learnt, from Jan Łukasiewicz's (1878–1956) monograph on the principle of contradiction in Aristotle (*O zasadzie sprzeczności u Arystotelesa*, Cracow 1910), of Bertrand Russell's antinomy concerning the class of classes that are not elements of themselves. The antinomy fascinated him and eventually led him to construct a new system of the foundations of mathematics noted for its comprehensiveness, originality, and formal elegance. The system consists of three deductive theories, called by him *protothetic, ontology* and *mereology*. *Protothetic*, which presupposes no logically earlier theory, corresponds to a functionally complete system of the two-valued logic of propositions, supplemented with the principle of bivalence and inclusive of the theory of quantification. *Ontology* presupposes *protothetic* and is a kind of modernized traditional logic. Formally it approximates Ernst Schröder's (1841–1902) '*Klassenkalkül*' considered jointly with the theory of 'individuals'. *Mereology*, that is to say a theory of part-whole relations, presupposes both *protothetic* and *ontology*. It was the first deductive theory devised by Leśniewski. Originally it was meant to buttress his analysis and solution of the Russellian antinomy. He included it in his system to serve as a possible presupposition of an axiomatized geometry.

Aristotle's syllogistic, traditional logic, Gottlob Frege's *Grundgesetze der Arithmetik*, and Whitehead and Russell's *Principia Mathematica* can be counted among the antecedents of Leśniewski's system. It embodies all the recommendable aspects of the *Grundgesetze* and *Principia* and is free from the shortcomings of either. Like Frege, Leśniewski was very critical of the 'formalistic' treatment of deductive theories. In his view deductive theories, whether mathematical or not, ought to describe reality in terms of precise laws or principles. The axioms of the deductive systems he had constructed were for him indubitably true whereas the rules of definition, inference, and extensionality, called by him directives, were in his belief

irresistibly cogent. Like Frege he condemned the practice, favoured by some mathematicians, of 'inventing' objects, and would certainly join Russell in maintaining that "logic is concerned with the real world as truly as zoology". Unlike the authors of *Principia*, who regarded definitions as theoretically redundant, Leśniewski considered definitions to be integral parts of his deductive systems. He saw nothing wrong in using them 'creatively'. Unlike the system of Frege's *Grundgesetze*, Leśniewski's system of the foundations of mathematics is consistent. Unlike the system of *Principia*, his standard systems of *protothetic* and *ontology* are formalized. By the formalization of a deductive system Leśniewski did not mean its symbolization but an unequivocal statement of syntactical conditions an expression has to satisfy if it is to be added to the system as a new thesis. Prior to the formalization of *protothetic*, Leśniewski worked out a theory of 'semantical categories', which constitutes the grammar of his symbolic language. In view of the role definitions play in his theories, this language is not static. Its vocabulary 'grows' and so does the categorial variety of its expressions.

Tadeusz Kotarbiński (1886–1981), the propounder of reism, was the first philosopher to realize that Leśniewski's *ontology* had met the specification of Aristotle's "science of being *qua* being", occasionally referred to as 'first philosophy'. For *ontology* is in fact a theory of entities or objects. Being a very general theory it is open to extensions into more particular theories describing objects in greater detail. *Mereology* is such an extension, to be followed by *chronology*, which describes objects as extended and ordered in time. *Stereology's* task would be to describe objects as extended and distributed in space. A description of objects in motion would be the purpose of *kinematics*. It is to be hoped that the suggested extensions will one day achieve the standard comparable at least to that of Leśniewski's *mereology*.

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CZESŁAW LEJEWSKI

Lewin, Kurt

Kurt Lewin was born in Mogilno, Prussia, on 9 September 1890 and died in Newtonville, Mass., on 12 February 1947.

Lewin studied medicine and biology before turning to philosophy and psychology. From 1919 to 1932/3 he worked at the Psychological Institute of Berlin University. Being forced to emigrate in 1933, he went to Cornell University and from there to the University of Iowa where he focused on child research, and to MIT where he established the Research Center for Group Dynamics.

The neo-Kantian Ernst Cassirer (1874–1945) and the philosopher and psychologist Carl Stumpf (1848–1936) were Lewin's teachers in Berlin. Both exercised a powerful influence on his conception of psychology as a discipline related to the other sciences as part of a larger superstructure handled by *Wissenschaftstheorie*. Lewin proposed that psychology ought to rid itself of Aristotelian ways of concept formation and to move into the so-called Galileian mode. This assertion is coupled with the view that induction is less important than is usually assumed by psychologists; the passage from observed regularities to the establishment of universally valid laws has to be supplanted by a Galileian approach to science based on strict theorizing and subsequent validation. (See his often-quoted article "Gesetz und Experiment in

der Psychologie", *Symposion*, 1, 1927, pp. 375–421).

In Berlin Lewin came in close contact with Wolfgang Köhler (1887–1967) and Kurt Koffka (1886–1941), pioneers of Gestalt psychology. Lewin himself was responsible for transferring basic conceptions of the latter into the domains of the psychology of emotion and motivation, of volition, and of development and personality. (See *Vorsatz, Wille und Bedürfnis*, Berlin, 1926; *A Dynamic Theory of Personality*, New York, 1935).

Following the example of the Gestalt theorists as well as his own inclination towards a unification of the sciences, he employed in his experimental and theoretical contributions to psychology numerous concepts of mathematics and physics, including such as field, force, energy, tension, valence (*Aufforderungscharakter*), vector as well as terminology taken over from mathematical topology and hodology. (See *Principles of Topological Psychology*, New York, 1936; Lewin and Karl Korsch, "Mathematical constructs in psychology and sociology", *Erkenntnis – the Journal of Unified Science*, (Appendix – intended vol. 9), 8, 1940/1, pp. 397–403.)

Lewin employed the adopted terms in a rather vague fashion, as critics like I. D. London (1944) were soon to point out. He possessed, nevertheless, a certain ingenuity in creating new ideas of research. Thus group dynamics and sensitivity training were his creations, and Lewin carried out pioneering experimental research in social and political psychology and did much to advance applied psychology, e.g. in the area of conflict resolution (*Resolving Social Conflicts*, New York, 1951).

Lewin's early work in *Wissenschaftstheorie*, the root of his later views in this field, is less well known, as new manuscript material has been published only recently in the framework of the new edition of his works (*Kurt-Lewin-Werkausgabe*, Bern, 1981–).

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HORST GUNDLACH

Lewis, David

An American philosopher born in 1941, David K. Lewis has written extensively and influentially on a wide range of topics, not only in metaphysics but also in logic, philosophy of language, and philosophy of mind. His work is unified by self-imposed constraints of a metaphysical character. Most importantly, he commits himself to what he calls the doctrine of 'Humean supervenience' – that "all there is to the world is a vast mosaic of local matters of particular fact. . . . All else supervenes on that" (Lewis 1986a, pp. ix–x). Amongst 'all else' Lewis includes laws of nature, causal relations, persistence through time, mind and meaning, and much more besides (though *chance*, he admits, threatens to prove recalcitrant). However, Lewis departs from David Hume in contending that this, the actual world, is not the only possible world there is, and for Lewis modal truths in this world depend on what is or is not the case in other possible worlds. Notoriously, Lewis advocates a full-blooded realism concerning the ontological status of non-actual possible worlds, regarding them as no different in kind from the actual world albeit spatio-temporally and causally isolated from it and from each other (Lewis 1986b, pp. 1–3). According to Lewis, indeed, 'actual' functions as an indexical expression rather like 'here' and 'now' (Lewis 1986b), and consequently does not pick out any one possible world as having a privileged ontological status (contrast Leibniz's view that this world, being the best of all possible worlds, is the one which God uniquely chose to realize).

Lewis's extreme brand of 'modal realism' has come under attack from many quarters and on various grounds. It is accused of

extravagance and violation of Ockham's razor, though Lewis himself vigorously argues that alternative non-realist accounts of possible worlds do not work (Lewis 1986b, pp. 136–91). It is also often held against Lewis that, precisely because he makes modal truths in this world turn on happenings in other worlds causally isolated from us, he cannot give an adequate account of our *knowledge* of such modal truths (Stalnaker 1988). More fundamentally, it is complained against Lewis's theory that it is simply not the case that what we believe when, say, we believe that Humphrey might have won the 1968 presidential election has anything to do with supposed political goings-on in alternative universes (Salmon 1988). A crucial feature of Lewis's theory is that individuals do not exist in more than one possible world, so that 'our' Humphrey is not transworld-identical with any winning candidate in another world, but at best has a 'counterpart' in another world who wins there.

Lewis exploits his theory of possible worlds in giving interrelated and technically rigorous analyses of counterfactual conditionals, causation, and events (Lewis 1986a). He goes on to make use of the theory and of these analyses in exploring further metaphysical issues such as the problem of universals, the status of natural laws, the direction of time, and the persistence through time of continuant objects, including persons.

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EDWARD JONATHAN LOWE

Lipps, Theodor

Theodor Lipps (1851–1914) was born in Wallhalben, near the Saar, the son of a Protestant pastor. After his studies in theology, he studied philosophy and the natural sciences. He received his doctorate in 1874 with his dissertation, *Zur Herbartschen Ontologie*, from the University of Bonn, where he also earned his habilitation in 1877. After the publication of his *Grundtatsachen des Seelenlebens* (1883), which was influenced by Rudolf Hermann Lotze (1817–81) and Wilhelm Wundt (1832–1920), Lipps was named extraordinary professor in 1884. In 1890 he followed a call to the University of Breslau, where he wrote the *Grundzüge der Logik*, a work which later brought on the charge of psychologism. He was then called in 1894 to be successor to Carl Stumpf at the University of Munich, where he remained until the end of his life.

Lipps always conceived psychology, the science of conscious experiences in general, as the fundamental science of philosophy. As descriptive psychology it investigates and analyses, with the help of the method of introspection, the immediately accessible, evidently given contents of consciousness. As explanatory psychology it traces the contents of consciousness to their real causes outside of consciousness. The charge of psychologism, put forward by both Edmund Husserl and Paul Natorp (1854–1924), was rejected by Lipps, in as much as psychology was conceived by him not as empirical but as the science describing the essences of the processes of consciousness. Moreover, from the turn of the century he emphasized the distinction between subjective experiences of consciousness on the one hand and the experience of objective requirements on the other. Such experienced objective requirements, as they appear in thought, serve as the basis of logic, and as they appear in volition and feeling as the basis of ethics and aesthetics, respectively. Lipps illustrated the essence of the experiences of requirement in his account of the concept of reason.

After the turn of the century, the concept of 'empathy' ('*Einfühlung*') gains increasing significance in Lipps's work. Thus it is used in the explanation of the possibility of knowledge of the connection between inorganic and organic nature, of other human beings (social philosophy) and of art ('aesthetics of empathy'). Lipps defended his theory of

empathy against attacks in his final work, *Zur Einfühlung* (1913).

In metaphysics, the science of absolute reality, Lipps propounded a version of panpsychism. Behind the outer and inner world, there is considered to be an ultimate material-spiritual world-basis, both matter and spirit being modes of a single absolute reality, which becomes progressively differentiated in world history.

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WOLFHART HENCKMANN

Locke, John

John Locke (1632–1704) was educated at Westminster School, London, and Christ Church, Oxford where he studied grammar, Greek, history, moral philosophy, and other such subjects. He also studied medicine and qualified as a doctor. He did not like the generally scholastic philosophy he encountered at Oxford, and a friend reported that "the first books, as Mr. Locke himself has told me, which gave him a relish of philosophical things, were those of Descartes". Elected fellow of the newly formed Royal Society of London for the Improving of Natural Knowledge in 1668, he was closely connected with the 'new philosophy', and was a friend and correspondent of the natural philosophers Robert Boyle (1627–91) and Sir Isaac Newton. Known and active in public affairs from his connections with Lord Ashley, 1st Earl of Shaftesbury (1621–83), he wrote and published on a considerable variety of topics – not only various branches of philosophy, but also education, economics, and medicine. He is best known for his *Essay Concerning Human Understanding* (1960), and *Two Treatises of Government* (1690); but *Letters Concerning Toleration* (1689–92), *Thoughts Concerning Education* (1693), and *Reasonableness of Christianity* (1695) are important too.

He aimed in his masterwork, the *Essay*, to "enquire into the Original, Certainty, and Extent of humane Knowledge". His aim was partly ethical. He wished to curb our immodest pretensions to knowledge "about things to which our understandings are not fitted" so that we will "learn to content ourselves with what is attainable by us in this state". So far as its origin goes, he roundly dismisses the idea that any knowledge is innate; nevertheless, though commonly known as an empiricist, he did not think that knowledge comes directly from experience. The *ideas* that experience directly provides are merely the materials of knowledge. Knowledge itself is a product of our reason which, either intuitively or demonstratively, discerns connections between ideas.

But such knowledge has its limits: natural philosophy is not capable of being developed as a scientific body of knowledge such as geometry, and there is much about which we are ignorant: the constitution of matter, whether matter can think, what the essence of mind is, the relationship between body and mind. But our beliefs about the properties, powers, and operations of substances in the world are sufficient for everyday practical "Conveniences of Life". These limits to our knowledge should be of no concern to us. "Morality is the proper Science and Business of Mankind". Our real concern is with our duties and obligations to each other and to God.

Natural philosophy has to use the "plain, historical method" of experiment and observation, and will never become a true science, because of our ignorance of the real essences of the substances such as gold and lead with which it deals. Locke understood these essences, not in terms of the scholastic doctrine of substantial forms which (along with Boyle) he firmly rejected, but in terms of the newly revived corpuscular theory of the ancient Greeks. Our ideas or nominal essences of substances concern their observable properties and we have no knowledge that these properties are necessary features of them. On the other hand, we can know the

real essence of what Locke terms "modes" such as geometrical figures: and, knowing them, we are in a position to demonstrate and prove their properties, not merely observe them. Moral ideas are modes too, and Locke thinks that morality, the proper business of mankind, could be developed into a demonstrative science.

The corpuscular theory connects with the distinction between primary and secondary qualities. The distinction is popularly associated with Locke's name but was not in fact due to him. Some such distinction was held by the ancient Greeks, and by others in Locke's century, such as Galileo and Boyle. Just as the pain that we feel resembles nothing in the pin that pricks us, so, Locke argues (in effect against the scholastic doctrine of sensible species), the same goes for all the other qualities that he terms "secondary", colours, tastes, and so on. What these are, in the objects themselves, are a certain arrangement or "texture" of corpuscles which possess only the primary qualities of size, shape, solidity, mobility.

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ROGER S. WOOLHOUSE

Logic
I: The Syllogism

A syllogism, according to Aristotle (*Prior Analytics* 24b18–22) is a piece of reasoning (λόγος) in which, certain things being proposed, something other than them results of necessity from their being so; for example: 'If *A* is affirmed of all *B*, and *B* of all *C*, necessarily *A* is affirmed of all *C*'.

The question of the ontological status of the syllogism is not discussed by Aristotle. However, it is clear that a syllogism is neither an action of drawing an inference nor a disposition towards such actions. Rather, a syllogism is the content of such an action, in a sense which allows the same content to be shared between spoken, written, and mental reasoning.

The syllogism was devised by Aristotle as a rigorous instrument with which to formulate demonstrations incorporating scientific knowledge about the species of naturally occurring things. Its underlying motivation thus included a metaphysics of natural kinds. But Aristotle's syllogistic as such is not committed to the existence of natural kinds or to the truth of those propositions about them which belong to Aristotelian science. Neither this metaphysics, nor any other, is required by the syllogistic. Indeed, it is one of the strengths of Aristotle's syllogistic that it is metaphysically neutral, in the sense that arguments whose premisses are based on non-Aristotelian metaphysical theories are expressible and assessable in it.

The categorical propositions of the syllogistic can be given an intensional interpretation:

> A universal affirmative with subject A and predicate B is true iff there are natural kinds **A** and **B** corresponding to A and to B such that **A** is identical with, or is a species of, **B**. A particular affirmative with subject A and predicate B is true iff there are natural kinds **A** and **B** corresponding to A and to B, and there is a natural kind **C**, which is either identical with or is a species of **A**, and is either identical with or is a species of **B**.
>
> A particular negative is true iff its corresponding universal affirmative is not true; and a universal negative is true iff its corresponding particular affirmative is not true.

Though Aristotle himself substitutes natural-kind terms for his syllogistic variables, he also substitutes other terms, including singular terms (e.g. *Prior Analytics*, 47b24–33) and negated terms.

In addition, categorical propositions can be given an extensional interpretation:

A universal affirmative with subject A and predicate B is true iff there are classes **A** and **B** corresponding to A and to B such that **A** is non-empty and is included in **B**.
A particular affirmative with subject A and predicate B is true iff there are classes **A** and **B** corresponding to A and to B, and there is a non-empty class **C**, which is included in both **A** and **B**.
A particular negative is true iff its corresponding universal affirmative is not true; and a universal negative is true iff its corresponding particular affirmative is not true.

Aristotle's own substituends for his variables are not always consistent with this class interpretation. Sometimes (e.g. 26b3–10), they are mass-terms such as 'snow'.

It should be noted here that the so-called existential commitment of categorical propositions does not imply that only beings can be subjects of true affirmative propositions. This is shown by *Prior Analytics*, 49a23–4, where it is said to be not only true but demonstrable that the goat-stag is, as a non-being, an object of knowledge. The conclusion of such a demonstration would take the form: 'Of the goat-stag there is knowledge that it is a non-being'. This is taken by Aristotle to be a true proposition about a non-being, the goat-stag. If it is a true proposition, then since knowledge is only of truths, the proposition 'The goat-stag is a non-being' is itself true, though it is about that same non-being, the goat-stag. It seems therefore that, for Aristotle, some things are non-beings; and affirmative propositions have only to be about something, not necessarily about a being.

Categorical propositions can also be given a mereological interpretation:

A universal affirmative with subject A and predicate B is true iff there are quantities of stuff **A** and **B** corresponding to A and to B such that **A** is a (possibly improper) part of **B**. A particular affirmative with subject A and predicate B is true iff there are quantities of stuff **A** and **B** corresponding to A and to B such that there is a quantity of stuff **C** which is a (possibly improper) part of both **A** and **B**. A particular negative is true iff its corresponding universal affirmative is not true; and a universal negative is true iff its corresponding particular affirmative is not true.

Again, though Aristotle sometimes substitutes mass-terms for his variables, not all his substituends are of this type.

Thus, while Aristotle's syllogistic was motivated by a particular ontology, it is compatible with others, and even in its author's eyes it necessitates none, as is clear from the great variety of applications to which he puts it.

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PAUL THOM

Logic
II: Post-Medieval Logic (14th–17th Centuries)

Post-medieval logic can only be understood in relation to late medieval logic, so this should be our starting-point. At the end of the 14th century there were roughly three categories of work available to those studying logic. The first category is that of commentaries on Aristotle's *Organon*, whether as a whole or in part. The second category is that of works on non-Aristotelian topics. These include the so-called *parva logicalia*, or treatises on supposition, relative terms, ampliation, appellation, restriction, and distribution. To these could be added tracts on exponibles and on syncategorematic terms. Peter of Spain (*c.* 1210/20–77) is now the best-known author of *parva logicalia*, but such authors as Thomas Maulvelt and Marsilius of Inghen were almost as influential in the late 14th and 15th centuries. Another group of

works belonging to the second category consists of the so-called 'tracts of the moderns', namely treatises on consequences, obligations, and insolubles. There are also treatises on sophisms, on the composite and divided senses, and on proofs of terms, especially the well-known *Speculum Puerorum* by Richard Billingham (fl. *c.* 1350). The third and last category is that of comprehensive textbooks. The most famous example is the *Summulae Logicales* of Peter of Spain, which gives a complete outline of Aristotelian logic, including categories, syllogisms, topics, and fallacies; but John Buridan's *Summulae*, which was printed several times with a commentary by John Dorp, and Paul of Venice's *Logica Parva*, which was to be very popular in Italy in the 15th and 16th centuries, must also be mentioned. All three categories of works had a role in the curriculum of the late medieval university, though the authors and tracts chosen varied from place to place. It is a mistake to think that Peter of Spain provided the only supplement to Aristotle, for in some places he was not read at all, and in other places only a part of his work was read. Moreover, when studied he was studied through the medium of later commentators.

The medieval traditions of logical writing survived well into the 16th century, particularly at Paris and the Spanish universities, though with considerable internal changes. Treatises on sophisms and on proofs of terms ceased to be written; whereas there was a sudden flurry of activity concerned with the various divisions of terms and with the opposition of propositions, i.e. the logical relations between different kinds of categorical proposition. These internal changes were not, however, sufficient to keep the tradition alive, and after about 1530 not only did new writing on the specifically medieval contributions to logic cease, but the publication of medieval logicians virtually ceased. The main exceptions were the logical commentaries by (or attributed to) such authors as Thomas Aquinas and John Duns Scotus, which found a place in their *Opera Omnia*, and which benefited from a revived interest in the great medieval metaphysicians.

The main changes in the teaching and writing of logic during the 16th century may have been due to the impact of humanism, and the revised educational system it produced. First, commentaries on Aristotle came to display a totally new style of writing. One reason for this was the influence of new translations of Aristotle, and new attitudes to the Greek text. Another reason was the gradual publication during the early 16th century of the Greek commentators on Aristotle's logic, Alexander of Aphrodisias, Themistius, Ammonius, John Philoponus, and Simplicius. A third reason was the new emphasis on Averroes (1126–98), which expressed itself in the great Aristotle–Averroes edition of 1550–2. The effects of these new factors can be seen in the commentaries on individual works of the *Organon* by such Italians as Agostino Nifo (*c.* 1469/73–*c.* 1546) and Jacopo Zabarella (1533–89), the latter of whom offered a particularly influential account of scientific method. They can also be seen in the *Organon* edition of Giulio Pace (1550–1635), which was first published in 1584 and contained the Greek text side-by-side with a new translation which was designed not only to read well but also to capture the philosophical significance of Aristotle's words. The culmination of the new style of writing on Aristotle is found in the *Commentarii in Universam Dialecticam Aristotelis* by the Jesuits of Coimbra which appeared in 1606. This has aptly been described as presenting a fusion of two late 16th-century approaches to Aristotle, the philosophical one of Zabarella and the philological one of Pace. In addition it contains a wealth of material about different interpretations of Aristotle found in the Greek and Arab commentators, the medieval writers such as Aquinas, and more recent Thomists such as Cajetan and John Capreolus (*c.* 1380–1444). One finds the occasional reference to William Ockham or Marsilius of Inghen, but the perception of who constituted the important logical writers of the Middle Ages had clearly changed radically since the beginning of the 16th century.

Humanism can also be held at least partially responsible for the virtual disappearance of works on the specifically medieval contributions to logic, including the *parva*

logicalia, and for the replacement of medieval textbooks by textbooks in a completely new style. The disgust that humanists expressed at the barbarous language and twisted Latin of the scholastics was in itself a minor factor; and one must always remember that the most famous expressions of this disgust were contemporaneous with the enthusiastic reception of late 14th-century Oxford logic into Italian universities, where it held sway for at least a century. More important were the philosophical ideals that lay behind the work of Lorenzo Valla (*c.* 1405–57) and his follower Rudolph Agricola (*c.* 1443–85). As Lisa Jardine has argued (1977, 1988), both Valla and, to a lesser extent, Agricola were concerned to offer a logic which was linked with Cicero's academic scepticism rather than with Aristotelian certainties. They wished to present argumentative strategies for rendering plausible each of the two sides of an undecidable question, or for supporting one of them as, perhaps only marginally, more plausible than the other. They were thus drawn to consider a variety of non-deductive strategies in lieu of the formal techniques which had dominated a large part of medieval logic, especially in the treatises on consequences, and in lieu of Aristotle's own syllogistic. Their attention was focused on the Topics which, especially as presented by Cicero (106–43 BC) and Quintilian (*c.* 35–*c.* 96), seemed to offer a method of classifying these strategies by their key terms rather than by their form. At the same time, much of Agricola's concern was with the art of discourse as such, that is, with the problem of presenting and organizing complete arguments and narrations, whether written or spoken. Logic, or as he preferred to call it, dialectic, was to be applied to all types of discourse, and hence to all areas of teaching. As a result of this interest both in persuasive techniques and in discourse as such, logic came to embrace much of what had traditionally been regarded as belonging to rhetoric; and rhetoric came to be seen as concerned not with the invention of topics but with the ornamentation of discourse.

These doctrines as presented in Agricola's *De Inventione Dialectica libri tres*, first published in 1515, turned out to be seductive. One of those who was considerably influenced by Agricola was Philipp Melanchthon (1497–1560), whose logic text, first published in 1520 as *Compendiaria Dialectices Ratio* but replaced by two later versions, became very popular. In it we see how the insights of Valla and Agricola were transmuted to serve the textbook tradition. Melanchthon enjoyed the Agricolan emphasis on clarity of style and the use of literary allusions; he accepted the importance of the Topics and that part of logic called invention; and some remarks on order in the first version of this text grew into a full section on logical method as a way of ordering discourse. At the same time, Melanchthon was a convinced Aristotelian. The formal techniques he used were those of syllogistic, and his work included a discussion of the other standard Aristotelian subjects including the categories and the square of opposition for propositions. Indeed, the last version of his logic, the *Erotemata Dialectices* of 1547, seems considerably less Agricolan in tone than the earlier versions, though it retains references to Cicero and Quintilian.

Another writer who was influenced by Agricola is Peter Ramus or Pierre de la Ramée (1515–1572), the most notorious logician of the 16th century. He is known both for his attacks on Aristotle and for the simplified logic presented in his *Dialectique* of 1555 (published in Latin in 1556 as *Dialecticae libri duo*), a work which enjoyed a remarkable publishing history. There were at least 262 editions, 151 of which appeared in Germany. The *Dialectique* had two parts. The first, on invention, covered the Topics; and the second, on judgement, presented a deliberately simplified version of the syllogism followed by an account of method as a means of ordering in the arts and sciences. No reference was made to such standard material as the categories, the square of opposition, conversion, demonstration, and fallacies. On the other hand, the work is rich with quotations from the poetry and prose of classical authors, which must have strengthened the impression among students that logic was both easy and fun.

Whatever its attractions, the deficiencies of Ramus's book as a teaching tool became rapidly apparent to those seriously interested

in logic at the university level. As a result, a new school of textbook writers known as the Philippo-Ramists appeared in Germany in the 1590s. These authors had the aim of combining what was best in Ramus with what was best in the more Aristotelian work of Philipp Melanchthon. Thus they tended to restore all those parts of Aristotelian logic which Ramus had deliberately omitted. One important writer who can be seen as allied to the Philippo-Ramist school, though he is more frequently described as a systematic, is Bartholomew Keckermann (*c.* 1571/3–1609). Keckermann was primarily concerned to defend Aristotle and such Aristotelians as Zabarella, but he paid careful attention to Ramist doctrines. He was particularly noteworthy for his theoretical discussion of the notion of a system, and the criteria for determining whether a body of doctrine, such as logic or ethics, could properly be called a system.

Another important group of textbooks from the latter half of the 16th century owed a smaller debt to the humanist logic of Rudolph Agricola and Peter Ramus, and is noteworthy for an attempt to integrate certain parts of the specifically medieval contribution to logic into a generally Aristotelian framework. I shall mention three such texts. The earliest, and most medieval in tone, is the *Compendium Logicae* by Chrysostom Javelli (died *c.* 1538) which was first published posthumously in 1551. Javelli retained discussion of such topics as the proofs of terms, and he also retained a number of sophisms and puzzle-cases from the medieval literature. He can therefore be described as a transitional author, representing an intermediate stage between the old medieval textbooks and the Counter-Reformation texts of the Jesuits Francisco de Toledo (1533–96) and Peter of Fonseca (Pedro da Fonseca (1528–99)). Toledo's *Introductio in Dialecticam* was first published in 1561 in Rome; and Fonseca's *Institutionum Dialecticarum libri octo* was first published in 1564 in Lisbon. The Jesuit *Ratio Studiorum* of 1586 had recommended the *Summula* of Fonseca for its breadth, clarity, relevance to Aristotle, and lack of sophistry; and in the *Ratio Studiorum* of 1599, Toledo was recommended in addition to Fonseca. The two books share important features. Their main objective is to present standard Aristotelian logic. This material is supplemented with an account of certain medieval doctrines, specifically supposition theory, exponible propositions, and consequences, but the presentation of these doctrines is new. There is a complete absence of the sophisms which had formed a prominent feature of late medieval texts. There is also little discussion of problems caused for such operations as conversion by the presence of different linguistic structures. The highly technical language which struck the humanist as barbaric is gone, and, in Fonseca at least, there is a conscious attempt to use classical terminology. All three texts were widely disseminated in Europe and, interestingly enough, all seem to have received their last printed editions in the 1620s.

The features which came to characterize logic texts by the end of the 16th century might be summarized as follows: the appearance of references to Greek textual scholarship; the discussion of method, whether scientific method or method as a means of organizing discourse; the use of a more strictly Aristotelian framework than had characterized medieval texts; the disappearance of strictly medieval doctrines with the possible exception of supposition theory, exponibles, and consequences; and the attempt to write teaching manuals which are simplified both in language and structure. All these features are found in such 17th-century texts as the *Logicae Artis Compendium* of Robert Sanderson (1587–1662/3) published in Oxford in 1615, and the *Logica Hamburgensis* of Joachim Jungius (1587–1657), first published *in toto* in Hamburg in 1638. There are exceptions such as the *Ars Logica* by John of St. Thomas (1589–1644) which was published in Alcalá 1631–2, and which drew very heavily on such earlier Spanish writers in the medieval tradition as Domingo de Soto (*c.* 1494/5–1560); but such exceptions were rare.

Why these changes came about is a difficult question to resolve. Humanism coexisted too long with medieval logic for humanism to be the sole explanation; and the return to

Averroes and Aquinas shows that mere revolt against anything medieval is not a sufficient explanation either. Changes in grammar teaching; changes in the relation of logic to the study of natural science; and changes in other parts of the university curriculum presumably have a good deal to do with the appearance of a new style of logic. So too do Reformation, Counter-Reformation, and the resulting changes in theological studies. The logic needed for the study of the Church Fathers and Aquinas's *Summa Theologia* was not that which had been needed to unravel Peter Lombard's (*c.* 1100–64) *Sentences*. But a final answer to the question will have to await further research.

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Logic
III: 19th-Century English Logic

Logic in the English-speaking world revived in the early 19th century, having been in eclipse for over a century due to the empiricists' contempt for 'trivial' syllogistic reasoning. This attitude survived in the work of J. S. Mill (1806–73). Deductive reasoning, he claimed, was 'merely verbal' and his *System of Logic* (1843) made little contribution to formal logic, its value lying in discussions of scientific method and philosophy of language.

The *Elements of Logic* (1826) of Richard Whately (1787–1863) revived interest in the details of traditional logic. It prompted influential work by Sir William Hamilton (1788–1856), who developed earlier ideas about quantification of predicates. He encouraged efforts to extend traditional lists of valid argument forms and stressed the formulation of logic as a formal calculus. The stimulus this provided is easily underrated, as is the importance he attached to careful extensional treatments of these forms of deductive reasoning. Augustus De Morgan (1806–71) was hampered by continuing to work within the syllogistic framework, but he invented the first modern notation for the logic of relations and developed the extensional approach by employing class names (and negative terms) within the classical approach to logic.

The most important figure in these developments is George Boole (1815–64). Whereas Hamilton and his followers were still motivated by philosophical concerns, their notations being perspicuous abbreviations of ordinary English, Boole brought mathematical precision and mathematical operations to logic. Aware that algebras can be studied in abstraction from particular interpretations, he developed algebras that could be used for the study of argument. Boolean algebra provided a stimulus to mathematical approaches to logic which abstract from immediately philosophical concerns (indeed, a weakness of his systems was the inclusion of formulae with no intelligible interpretation). It proved possible to interpret his algebras not only as formalizing the logic of terms but also as a propositional logic, and assigning primary importance to propositional logical forms was another major innovation of late 19th-century logic. John Venn (1834–1923) contributed to the philosophical understanding of Boole's work, turning logicians' attention to issues of the existential import of terms within Boolean algebra.

With Charles Sanders Peirce (1839–1914) – an American but properly part of the history

of logic in English – further links with contemporary logic are evident. He developed algebraic approaches to the logic of relations and propositional logic and introduced a modern style of quantification – in fact claiming that all conditional propositions were bound by a universal quantifier over cases. These algebras were developed more fully by Ernst Schröder (1841–1902). In later work, Peirce's search for a perspicuous logical notation led to a method of 'existential graphs' which in some respects resembles modern methods of natural deduction (or, some suggest, semantic tableaux). Unlike earlier 19th-century logicians, Peirce sought to formalize the reasoning of mathematicians, and he thus extended his logic to deal with continuity and with collections of different infinite cardinalities. Finally, moving beyond Boole, although Peirce's logic was properly formal and mathematical, he attempted to integrate it with his philosophical and ontological position.

Another major development, involving John Neville Keynes (1852–1949) among others, was a growing awareness of intensional phenomena – a train of research culminating in the formal work of C. I. Lewis (1883–1964). Mention should also be made of the idealist logic of F. H. Bradley (1846–1924) and Bernard Bosanquet (1848–1923). Bradley embraced a holistic organic picture of reasoning and judgement, and insisted that syllogistic patterns distorted the structure of judgement and inference, so that formal approaches to logic were partial and misleading. Although his writings may have challenged formal logicians to examine more closely the philosophical and ontological underpinnings of their views, they had little impact upon more recent developments in deductive logic.

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CHRISTOPHER J. HOOKWAY

Logic
IV: Polish Logic

The first serious contact of Polish scholars with modern formal logic took place in 1898, when Kazimierz Twardowski (1866–1938) lectured in Lvov on the new trends in logic. Twardowski's lectures were mainly devoted to the reform of Aristotle's syllogistic undertaken by Franz Brentano on the basis of the view that all judgements are existential in form. But Twardowski also treated the algebra of logic as developed by George Boole (1815–64) and Ernst Schröder (1841–1902). Twardowski was not a logician, but he prepared the ground for the development of logic in Poland by training his students in clear philosophical thinking and by pointing them in the direction of semantics, philosophy of language, and philosophy of science. Among Twardowski's students were many future logicians and philosophers very close to logic, including Jan Łukasiewicz (1878–1956), Kazimierz Ajdukiewicz (1890–1963), Tadeusz Czeżowski (1889–1981), Tadeusz Kotarbiński (1886–1981), and Zygmunt Zawirski (1882–1948). In 1910 Stanisław Leśniewski (1886–1939) came to Lvov to complete his Ph.D. thesis under Twardowski's supervision. Another logical group grew up in Cracow. It consisted mainly of mathematicians, including Stanisław Zaremba (1863–1942), Jan Śleszyński (1854–1931), and Witold Wilkosz (1891–1941). Leon Chwistek (1884–1944), a philosopher by training, also belonged to the Cracow logical circle.

Łukasiewicz was the first of Twardowski's students who became a professional logician. He was appointed professor of philosophy at Warsaw University in 1915 and his lectures on logic there were especially welcomed by the Warsaw mathematicians. According to the programme of the Polish mathematical school, also organized just at that time, the main interests of Polish mathematicians should be centred on set theory, topology, and their applications. Thus this programme stressed also the role of mathematical logic and foundations.

Leśniewski and Kotarbiński were given chairs in Warsaw University in 1919; the

chairs of Łukasiewicz and Leśniewski were located in the Faculty of Mathematics and Science. Together with mathematicians such as Wacław Sierpiński and Stefan Mazurkiewicz, Leśniewski and Łukasiewicz trained a group of logicians which included: Alfred Tarski (1902–83), Adolf Lindenbaum (1904–41/2), Mordechaj Wajsberg (1904–39/45), Stanisław Jaśkowski (1906–65), Bolesław Sobociński (1906–80), Moses Presburger (*c.* 1904–39/45), Jerzy Słupecki (1904–87), and Andrzej Mostowski (1913–75). Taken together, Leśniewski, Łukasiewicz, and their pupils form the famous Warsaw School of logic. Of all students of Leśniewski and Łukasiewicz, Tarski quickly became the third pillar of the school.

Due to Kotarbiński's activity, logic had also a very strong position among young philosophers in Warsaw. He trained, among others, Janina Hosiasson (later Mrs Lindenbaum, 1899–1942), Janina Sztejnbarg (later Mrs Kotarbiński, born 1901), Edward Poznański (1901–76), and Aleksander Wundheiler (1902–57). All of these worked in the philosophy of science. Czesław Lejewski (born 1913), Henryk Hiż (born 1917), and Jan Kalicki (1922–53) formed the last generation of logicians connected with the Warsaw logical circle; they completed their studies just before or even during World War II.

The potential of the Cracow group was unfortunately never realized and this circle practically died out in the 1930s. This was not least because the mathematicians in Cracow typically had very limited interests in logic.

In 1930 Chwistek was given a chair in mathematical logic at Lvov University. He organized a group of logicians in which Władysław Hetper (*c.* 1900–39/45) and Józef Pepis (*c.* 1900–39/45) were the most gifted thinkers. Moreover, Twardowski was still active as a teacher even in the 1930s, and with Ajdukiewicz he trained at Lvov many philosophers, including Izydora Dambska (1904–83), Maria Kokoszyńska (1905–80), and Henryk Mehlberg (1904–78), who worked in semantics, philosophy of science, and philosophy of language.

The Polish logical community was also joined by several priests, including Father Józef M. Bocheński (born 1902) and Father Jan Salamucha (1903–44).

Classical Sentential Logic. This, above all, was the speciality of the Warsaw School, and especially of Łukasiewicz who, together with Tarski, Lindenbaum, Sobociński, and Wajsberg, formulated numerous axiomatic bases for the sentential calculus. Perhaps Łukasiewicz's axiomatics with implication and negation as primitives became the best known. A special direction of research in the Warsaw School consisted in looking for the simplest formalization of logic. This led to the search for mutually independent axioms based on a minimal number of primitive terms and axioms, and also the search for shortest possible axioms. Łukasiewicz proved that the sentential formula *DDpDqrDDpDrpDDsqDDpsDps* can serve as a sole axiom of sentential logic based on *D* (one of the two so-called Sheffer functors), and that no shorter axiom is possible. The sentential calculus with variable functors, a very powerful system of sentential logic due to Łukasiewicz, also deserves attention. This system, like Leśniewski's protothetic, could be called an absolute classical sentential logic, since the principle of bivalence is among its theses. Finally, Jaśkowski worked out a natural deduction system for the sentential calculus and also for first-order logic.

Łukasiewicz invented in the early 1920s a special logical notation in which no punctuation symbols (parentheses or dots) occur; the above axiom for the *D*-calculus is expressed in Łukasiewicz's (also known as 'Polish' or 'bracket-free') notation. This symbolism fairly reflects more general views of the Warsaw School concerning economy and simplicity as properties of good logical systems.

The Warsaw School also investigated so-called partial sentential calculi, i.e. calculi based on only certain sentential functors not sufficient to define all possible logical constants of sentential logic. Leśniewski, Łukasiewicz, Sobociński, and Wajsberg proposed several versions of the equivalential calculus. Formalizations and axiomatizations of sentential logic based on implica-

tion as the sole connective are due to Łukasiewicz, Tarski, and Wajsberg.

Many-Valued Logic. This is commonly regarded as one of the major achievements of the Warsaw School, particularly of Łukasiewicz. He was here very strongly motivated by philosophy, especially by considerations about the principle of bivalence – every sentence is either true or false – as the metalogical counterpart of the ontological principle of determinism. Rejecting bivalence therefore opens the way logically for indeterminism. For Łukasiewicz, sentences about the future (cf. Aristotle's famous example 'there will be a sea battle tomorrow') provide a logical laboratory in which various intuitions about bivalence and its connections with determinism could be checked. Sentences about the future, Łukasiewicz argues, are neither true nor false; they have a 'middle' logical value. In 1918–20, Łukasiewicz completed the first formal system of three-valued logic. Together with Tarski, Wajsberg, Sobociński, Lindenbaum, and Słupecki he then developed finitely and infinitely valued logics, both axiomatic and also matrix based.

Modal Logic. Łukasiewicz believed that modal logic had to be an extension of many-valued logic. His first system of many-valued logic is based on the assumption that the middle logical value can be identified with possibility. However, Łukasiewicz did not complete his first attempt to base modal logic on three-valued logic. He came back to this problem in the 1940s and 1950s and proposed a new system of modal logic based on a four-valued logic and containing rules of rejection as separate rules of inference. This system, known as the Ł-system of modal logic, has the peculiar property that it is, contrary to Lewis-style modal systems, entirely extensional modal logic. This corresponds to the view, widespread in Poland, that logic should be entirely extensional. Several logicians in Warsaw did, however, contribute to Lewis-style systems. Wajsberg and Tarski worked out topological and algebraic semantics for modal logic, Sobociński proved the equivalence of several modal logics (for instance Feys's system *T* with von Wright's system *M*), and defined the so-called *K* family of modal logics.

Other Logical Systems. Jaśkowski, Wajsberg, Tarski, and Łukasiewicz formulated in the 1930s, 1940s, and 1950s several axiom systems for intuitionistic logic and obtained many important metalogical results concerning intuitionistic (sentential) logic. Jaśkowski found an adequate matrix for intuitionistic logic; this matrix is denumerably infinite. Wajsberg proved the so-called separation theorem, which states that each consequence deducible from the axioms of the intuitionistic sentential calculus is deducible just from those axioms which, in addition to implication, include only the sentential connectives that occur in the consequence itself. Tarski proved that the classical sentential calculus is the only consistent and complete extension of the intuitionistic sentential calculus and gave a topological semantics for the latter. Łukasiewicz proved a very surprising result that the intuitionistic sentential calculus contains the classical one as proper part. The proof was possible because Łukasiewicz used intuitionistic logic with variable functors. This result thereby shows the power of variable functor logics. The discursive logic developed by Jaśkowski in the 1940s and 1950s is an early system of paraconsistent logic.

Polish logicians had little interest in predicate logic. However, Pepis's investigations of the decidability of formulas of quantificational logic should not be overlooked.

Leśniewski's and Chwistek's Systems. Leśniewski worked on a comprehensive system of foundations of mathematics which consisted of protothetic (a system of extended sentential logic with quantifiers binding sentential and functor variables), ontology (the calculus of names), and mereology, a theory of part and whole.

It is indubitable that the Warsaw School of logic played the central role in Polish logic. Of the work of the logicians outside Warsaw, only that of Chwistek may be fairly compared with the achievements of the Warsaw logicians. Chwistek, like Leśniewski, attempted to formulate a complete system of foundations of mathematics. His first attempt consisted in combining ideas of Jules Henri Poincaré (1854–1912) and Bertrand Russell. He criticized the ramified type theory and

proposed a version of the simple theory of types. In the 1930s, Chwistek worked also on what he called *rational metamathematics*, a radically nominalistic system of logic and foundations of mathematics.

Metalogic, Metamathematics and Semantics. The work of the Warsaw logicians on particular logical systems gave rise in turn to metalogical research, and, especially in the work of Tarski, to general metamathematics. Łukasiewicz, Tarski, Wajsberg, Lindenbaum, Sobociński, and Słupecki proved many metatheorems on sentential calculi (completeness, consistency, independence of axioms) and defined several important concepts of metalogic, especially the concept of logical matrix. Tarski worked out the axiomatic theory of logical consequence and the general theory of logical systems. He also made precise various metamathematical concepts (of completeness, consistency, logical consequence, and so on). Of particular results, Lindenbaum's theorem on consistent and complete extensions of formal systems, Presburger's result that arithmetic with addition is complete, and Ajdukiewicz's discovery (under the influence of Leśniewski) of categorial grammar are of special importance.

Tarski's semantic theory of truth is undoubtedly the most important single achievement of Polish logic. Moreover, Tarski formulated a general condition for doing semantics: the semantic theory for a language L has to be done in a metalanguage ML which is essentially stronger than L. This condition blocks semantic paradoxes. Tarski's semantic works created a new paradigm of logic and initiated model theory in logic.

History of Logic. Łukasiewicz advanced the idea of studying the history of logic via concepts and methods of mathematical logic combined with a philological analysis of historical sources. The realization of this programme by Łukasiewicz himself and other Polish logicians, especially Bocheński and Salamucha, resulted in revolutionary achievements. In particular, it enforced crucial revisions of earlier histories of logic such as, for example, that of Carl Prantl. Łukasiewicz demonstrated that Stoic logic was just a logic of sentences and not a logic of terms. Important research was also done concerning Aristotle's syllogistic and its modern interpretations (Łukasiewicz, Ajdukiewicz, Bocheński, Jaśkowski), medieval logic (Łukasiewicz, Bocheński, Salamucha), history of modal logic (Bocheński), and ancient semiotics (Dambska).

Philosophy of Logic and Mathematics. Chwistek's circle defended a radical nominalistic logicism; logic and mathematics must be, according to Chwistek, subordinate to a nominalistic philosophy of formal sciences. A similar view was represented by Leśniewski who, moreover, regarded logic as the general theory of being.

Other Polish logicians, especially representatives of the Warsaw School, were, however, rather moderate in expressing their philosophical opinions on the nature of the formal disciplines. Although they essentially contributed to proof theory, the theory of logical types and intuitionistic logic, they normally abstained from philosophical assessments of formalism, logicism, intuitionism, etc. This attitude sometimes resulted in a sort of cognitive dissonance. For instance, Tarski used metamathematical tools consistent with Platonism but he privately expressed strong sympathies with nominalism. Owing to this liberal attitude with respect to fundamental controversies in philosophy of logic and mathematics, the Warsaw School could take up without prejudice those investigations that were interesting from a purely logical point of view.

Logic itself did, however, influence many views held by Polish philosophers. For instance, Kotarbiński's reism was very strongly influenced by logic and the same holds of Ajdukiewicz's radical conventionalism and his semantic epistemology.

Radical conventionalism is a standpoint concerning the role of language in our knowledge. This philosophical view is based on the assumption that advanced knowledge, which is for Ajdukiewicz represented by science, is coded by languages which are both closed and connected. Roughly speaking, a language L is closed, if any enrichment of its vocabulary by new expressions leads to a change of meanings of its old words. A

language is connected, if every subclass of its expressions has a meaning-connection with remaining expressions of this language. The total class of meanings of expressions of a closed and connected language is called by Ajdukiewicz a conceptual apparatus. Ajdukiewicz argues that two arbitrary conceptual apparatuses are either identical or mutually non-translatable. Now, radical conventionalism claims that an assertion or rejection of a scientific statement is always made relative to a fixed conceptual apparatus. Thus if we change our conceptual apparatus we can abstain from accepting certain (earlier accepted) statements, even when the experiential data are the same. Obviously, Ajdukiewicz's idea of closed and connected languages was motivated by opinions about logical languages current in the 1920s.

Ajdukiewicz's semantic epistemology is an attempt to draw ontological conclusions from epistemological assumptions. It is based on the following observation. Tarskian semantics shows us how to pass from statements about a language to statements about objects which the language speaks about. By analogy, we can ask how to pass from statements about knowledge to statements about the objects of knowledge. Tarski's analysis indicates that the transition from sentences about a language to sentences of this language requires a metalanguage which contains semantic terms. By analogy, the transition from the language of epistemology to the language of ontology is possible only in a language which contains names of thoughts as well as names of the things which these thoughts refer to. In particular, the objections of idealists (for instance, George Berkeley) against realists are simply ill-founded, since the former use languages in which there occur only names of thoughts. The idealistic language resembles the language of syntax. Due to the fact that semantics in general is not definable in syntax, the idealists are not able to express realistic claims in their own language and hence they are not able to mount an effective criticism of realism. In this and other ways the philosophical and metaphilosophical views introduced to Polish philosophy by Twardowski were essentially strengthened by contacts of Polish philosophers with mathematical logic.

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Logic V: Higher-Order Logics

Higher-order logic goes beyond first-order logic in allowing quantifiers to reach into the predicate as as well as the subject positions of the logical forms it generates. A second feature, usually excluded in standard formulations of second-order logic, allows nominalized forms of predicate expressions (simple or complex) to occur in its logical forms as abstract singular terms. (E.g., 'Socrates is wise', in symbols $W(s)$, contains 'is wise' as a predicate, whereas 'Wisdom is a virtue', in symbols $V(W)$, contains 'wisdom' as a nominalized form of that predicate. 'Being a property is a property', in symbols $P(P)$, or with λ-abstracts, $P(\lambda x P(x))$, where $\lambda x P(x)$ is read 'to be an x such that x is a property', contains both the predicate 'is a property' and a nominalized form of that predicate, viz. 'being a property'. Frege's well-known example, 'The concept *Horse* is not a concept', contains 'the concept *Horse*' as a nominalized form of the predicate phrase 'is a horse'.)

In nominalism, where predicate expressions do not stand for any universals beyond themselves, excluding the second feature is taken as a way to express the view

that nominalized predicates denote nothing and therefore are pointless in logical syntax. Most nominalists, intent on avoiding the ontological commitments of using predicate quantifiers, eschew even the first or essential feature as well; but such commitments can be avoided in a second-order logic where predicate quantifiers are interpreted only substitutionally, e.g. as having only first-order formulas as their substituends. Certain constraints must then be imposed on the comprehension principle (which determines when a formula qualifies as a substituend for a predicate variable), and the result of imposing those constraints is what is known as standard predicative second-order logic. The constraints simply exclude any formula containing a bound predicate variable from being a substituend for such a variable. (These constraints may also be extended to a nominalistic interpretation of standard ramified second-order logic.) What is excluded by such a nominalistic interpretation is validation of an 'impredicative' comprehension principle where formulas containing bound predicate variables would be qualified as legitimate substituends of those same predicate variables. Such an exclusion amounts to a version of the vicious circle principle, which for nominalism means that no predicate can be defined or specified in terms of a totality (such as the formulas that are the substituends of bound predicate variables) to which it belongs.

Gottlob Frege was the first to formalize a version of higher-order logic, initially, in his *Begriffsschrift*, with just the first feature of predicate quantifiers, but subsequently, in his *Grundgesetze*, with the second feature as well, where nominalized predicates as abstract singular terms are represented in terms of his notation for value-ranges (*Wertverläufe*). That a nominalized predicate in Frege's logic denotes a value-range (or class in the case of a monadic predicate), and not a property or relation (as the above examples indicate is its purport in natural language), is a consequence of Frege's commitment to an extensional logic. That commitment in turn is a consequence of the nature of the concepts and relations that Frege took to be the values of his bound predicate variables. In both his initial and his subsequent logic, in other words, Frege's interpretation of predicate quantifiers is not substitutional, and therefore not nominalist, as is easily seen in the fact that an impredicative comprehension principle is provable (and therefore validated as a logical truth) on the basis of his logic for those quantifiers. The concepts and relations that he took to be the values of the predicate variables bound by such quantifiers, or that such variables were said to 'indicate indefinitely' (*unbestimmt andeuten*), were not taken as universals in a fundamental sense, however, but were identified instead with functions from objects to truth-values. That is, it was in terms of the ontological nature of functions, and of functions from objects to truth-values in particular, that Frege explained the predicative nature of concepts (or what he also called properties) and relations, and it was because of that identification, or ontological reduction, that he was committed to an axiom of extensionality. Nevertheless, as entities that can be predicated of objects (even if only in the sense of functions that can be applied to objects as arguments), Frege's concepts and relations are universals.

Predicates, accordingly, stand for universals in Frege's logic, but they do not stand for universals in the same sense that singular terms denote objects (though Frege calls both the universals that predicates stand for and the objects that singular terms denote *Bedeutungen*). This difference in semantic content between predicates and singular terms corresponds to their different syntactic roles as unsaturated and saturated expressions, respectively; and that difference led Frege to explain the semantic difference in terms of an ontological difference between the unsaturated nature of the concepts and relations that predicates stand for and the saturated or self-subsistent nature of the objects that singular terms, including nominalized predicates, denoted. It is the unsaturated nature of predicates (as linguistic functions), and of the concepts and relations that they stand for (as functions from objects to truth-values), according to Frege, that explains their role and significance in predication.

First-order quantifiers, according to Frege,

stand for second-level concepts within which the first-level concepts and relations that predicates stand for fall. (E.g., that there exists a horse, in symbols $(\exists x)H(x)$, means that the first-level concept *Horse* falls within the second-level concept of objectual existence.) Second-level concepts themselves fall within third-level concepts, which in turn fall within fourth-level concepts, and so on *ad infinitum*. Frege did not include a symbolic representation of all higher-level concepts in his logical grammar, however, but kept it strictly second order. This was because he assumed that all higher-level concepts and relations could be represented in a certain manner by first-level concepts and relations (as described in second-order logic with bound predicate variables ranging over those concepts and relations), and that from a logical point of view all that could be said in terms of higher-level concepts and relations could already be said in terms of first-level concepts and relations and the objects that fall under them, including especially the objects denoted by nominalized predicates as abstract singular terms. All of higher-order logic, in other words, was to be expressed through the formal theory of predication of an impredicative second-order logic with nominalized predicates as abstract singular terms. The logic itself was to be based on the distinction between the unsaturated nature of the first-level concepts and relations that predicates stand for and the saturated nature of the objects that their nominalizations and other singular terms denoted.

Frege's distinction between predicate expressions and their nominalizations as abstract singular terms is also fundamental in any form of *conceptualism* in which concepts, including relational concepts, are unsaturated cognitive structures (e.g. cognitive capacities whose saturation or realization results in mental acts instead of Fregean truth-values). Frege's first-level concepts would then be replaced by predicable concepts (as cognitive capacities to characterize and relate objects in various ways), while his second-level concepts (or rather those represented by common noun or restricted quantifier phrases) would be replaced by referential concepts. In such a conceptualism, predicable and referential concepts, when jointly applied, mutually saturate each other (in a kind of mental chemistry) and result in a mental act, and, if overtly expressed, in a speech act as well. Predication in language and thought, in other words, is grounded in speech acts and judgements, where concepts are cognitive structures and not functions from objects to truth-values, and consequently where there is no commitment to an axiom of extensionality as there is on Frege's account. Still, as in Frege's logic, nominalized predicates cannot denote the concepts that the predicates in question stand for (since as unsaturated cognitive structures the latter are not 'things' or objects); but they need not for that reason be rejected as part of logical syntax and may instead be taken as denotationless singular terms. (Peter Abelard might be described, or at least logically reconstructed, as such a conceptualist, rather than as a nominalist, since he agrees that things may fall under the same intelligible universal, even though that universal is not a 'thing'.) In conceptual Platonism, on the other hand, nominalized predicates do denote, but instead of the extensional value-ranges (or classes) that Frege took them to denote, they are interpreted as denoting the properties and relations that are the intensional contents of the concepts that the predicates in question stand for. A conceptual Platonist is in this way able to explain how by means of our conceptual abilities we are able to lay hold upon the intensions of our concepts by starting out from those concepts.

Whether Abelardian or Platonist, a conceptualist, unlike a Fregean realist, must respect certain constraints regarding the human capacity for concept-formation, and those constraints, it is commonly argued, do not permit validation of an impredicative comprehension principle. That is, on this view, concept-formation must be in accordance with the vicious circle principle that no concept can be formed in terms of a totality to which it belongs. This is what is argued in particular in *constructive conceptualism*, where the constraints on concept-formation lead to a non-standard or 'free' predicative second-order logic (which may be ramified) where not all predicate expressions need

stand for a concept. Which predicate expressions do stand for a concept in such a logic is determined by meaning postulates (in applied forms of the logic) and the restricted comprehension principle describing the laws of compositionality for concept-formation in that logic. In *holistic conceptualism*, on the other hand, impredicative concept-formation is possible (such as the concept of a least upper bound in mathematical analysis), and the constraints of constructive conceptualism apply only to the construction of the so-called predicative concepts. Holistic conceptualism, in other words, goes beyond constructive conceptualism, and it does so by allowing for an idealized transition to a limit of the comprehension principles of ramified constructive conceptualism where, by holistic closure, impredicative concept-formation becomes possible.

Both constructive and holistic conceptualism can allow for a Platonist interpretation of nominalized predicates, but because our grasp of the intensional objects (i.e. the properties and relations) denoted by such abstract singular terms is mediated by the concepts whose contents they are, the result will lead either to a realist version of the vicious circle principle (as an ontological thesis about the existence of abstract objects as the contents of predicative concepts) or to an epistemological distinction between the constructive knowability of the Platonic forms that are the contents of predicative concepts as opposed to the non-constructive knowability of those that are the contents of impredicative concepts.

Traditional Platonism holds that what nominalized predicates denote as abstract singular terms are the same universals that those predicates otherwise stand for in their role as predicates. Bertrand Russell defended such a Platonist view in his *Principles*, but he left unexplained there how the same universal, e.g. a relation, can occur in a proposition both as a term (or logical subject) and as a relating relation (even though not as both in any single occurrence). Later, in his logical atomist phase, Russell denied that a relation could occur otherwise than as relating; but he also denied that nominalized predicates could occur as abstract singular terms of what he then took to be his logically perfect language (which turns out to be a version of ramified second-order logic).

Russell's official higher-order logic is not the second-order theory he was committed to in his philosophy of logical atomism, however, but the full logic of ramified types described in *Principia Mathematica*. The development of this logic arose out of Russell's attempt to overcome his famous paradox, which applied to the second-order logic that Frege described in his *Grundgesetze* as well as to the implicit second-order logic with nominalized predicates that Russell had in mind at the turn of the century when he first began to write his *Principles*. The solution, according to Russell, was to partition the totality of universals into an infinity of different logical types, and to represent each such logical type by a different type of predicate variable subject to its own laws of quantification.

Russell got the idea of his first theory of types from Frege's hierarchy of concepts, which he modified by his rejection of Frege's view of the unsaturated nature of concepts and by identifying the levels of concepts in Frege's hierarchy with the ranks of sets in Georg Cantor's hierarchy (and thereby in effect replaced Frege's predication nexus by an intensional form of the membership relation, viz. an exemplification relation for which the axiom of extensionality fails). In his later theory of types Russell included a further modification whereby each of the levels of concepts of Frege's hierarchy was to be ramified into yet a further hierarchy of 'orders'. (E.g., the property of having all the first-level/first-order properties of a great general is a first-level/second-order property that concrete individuals (objects of level zero) can have through having all the first-level/first-order properties of a great general.) But this further ramification, as F. P. Ramsey later noted, is not needed to resolve Russell's paradox, and the constraints it imposes on the types of universals that can be said to exist are inappropriate in the kind of traditional Platonist or *logical realist ontology* that Russell claimed he was advocating at the time of the development of this logic. In fact, in order to achieve the

reduction of mathematics that he claimed was the primary goal of his logical realism, Russell was forced to assume a special axiom of reducibility that was designed precisely to overcome and nullify those constraints.

Though Russell was a traditional and not a conceptual Platonist (in the period in question), much of the philosophical motivation for his *theory of ramified logical types* can be explained in terms of the constraints of constructive conceptualism regarding the logic of predicate quantifiers together with a Platonist interpretation of nominalized predicates as abstract singular terms. The *theory of simple logical types* (which drops the ramification of levels into orders and assumes an impredicative comprehension principle) that was subsequently favoured by Ramsey and others can be similarly explained in terms of holistic conceptual Platonism. This means that the infinity of different ramified logical types that Russell imposed on his logical syntax, and thereby on his Platonist ontology as well, can be collapsed in Frege's manner into a non-standard or 'free' ramified second-order logic with nominalized predicates as abstract singular terms and interpreted as in constructive conceptual Platonism. Similarly the infinity of simple logical types that Ramsey and others adopted instead can be collapsed into an impredicative second-order logic with nominalized predicates and interpreted as in holistic conceptual Platonism. Both versions of conceptual Platonism have been shown to be equiconsistent with their counterpart theory of logical types, and therefore both are free of the paradoxes to the same extent. Both, moreover, because of the unsaturated nature of concepts as cognitive structures and the saturated nature of the intensional objects (i.e. the properties and relations) that are the contents of those concepts, are also free of Russell's problem of explaining how the same universal can have a predicable as well as an individual nature; and, for the same reason, both are also free of confusing Frege's hierarchy of concepts with Cantor's hierarchy of sets. In this regard, conceptual Platonism provides an ideal philosophical framework for higher-order logic within which both Frege's and Russell's insights can be accommodated without the undesirable features or consequences of the frameworks originally assumed by either Frege or Russell.

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NINO B. COCCHIARELLA

Logic
VI: Free Logic

Free logics are logics devoid of existence assumptions with respect to their terms but whose quantifiers, nevertheless, have existential force. Despite anticipations in the first half of the 20th century (for example, in the work of J. B. Rosser) – and even earlier (for example by Bernhard Pünjer (1850–85)) – concentrated philosophical and technical study dates only from the mid-1950s. Now in abundant supply, they are an important development not only in the logic of terms but also in formal ontology. Their genesis and leading principles may be explained as follows.

In the Port-Royal theory of immediate inference which derived ultimately from Aristotle, inferences from a statement of the form

A: All *S* are *P*

to a statement of the form

I: Some *S* are *P*,

and from a statement of the form

E: No *S* are *P*

to a statement of the form

O: Some *S* are not *P*,

were counted valid. Here '*S*' and '*P*' are place-holders for general terms, terms which are true (or false) of each of possibly many objects. Moreover, inferences from an *A* statement to the negation of the corresponding *O* statement (and vice versa), and from an *E* statement to the negation of the corresponding *I* statement (and vice versa), were also counted valid.

It is well known that when *A* and *E* statements are interpreted as universal conditionals and *I* and *O* are interpreted as existential conjunctions, both *A* to *I* and *E* to *O* inferences, but not *A* to the negation of *O* inferences (and vice versa) and *E* to the negation of *I* inferences (and vice versa), break down unless the place-holder '*S*' is restricted to non-empty general terms – general terms true of at least one (existent) object. Corroboration is easily obtained by letting '*S*' be the empty general term 'planets between the Earth and the Moon' and '*P*' the non-empty general term 'in rotation around the Sun'. In traditional language, the inferences described above are preserved by requiring that all statements of the four basic forms – interpreted as indicated at the beginning of this paragraph – have *existential import* with respect to their constituent *general terms*.

The drastic policy requiring that all replacements of '*S*' in the four basic forms be non-empty has adverse consequences, however. First, it restricts the scope of the Port-Royal theory of immediate inference and thus precludes its use in assessing the validity of inferences containing empty general terms in subject position. For instance, the Port-Royal theory, under the current interpretation of *A*, *E*, *I*, and *O* statements, cannot be applied to many inferences containing statements of physical law, statements such as 'All bodies on which no external forces are acting move uniformly in a given direction'. This statement, many maintain, contains the empty general term 'bodies on which no external forces are acting'. Second, the restricted Port-Royal theory does not allow one to distinguish between inferences whose validity depends on no assumption that its constituent general terms in subject position are non-empty – such as the mutual inference between the appropriate *A* and the negation of *O* statements – from those whose validity does require such an assumption – such as the inference from the appropriate *A* to *I* statements.

In the modern logic dating from Gottlob Frege, object-language counterparts of the emptiness or non-emptiness of general terms became available; a general term (or predicate) '*S*' is non-empty (or true of at least one (existent) thing), just in case there exists an object *x* such that *Sx*. *A* to *I* and *E* to *O* inferences are modified to hold, in general, on the additional assumption that there is an object *x* such that *Sx*, but the mutual inferability of an *A* statement and the negation of the corresponding *O* statement and of an *E* statement and the negation of the corresponding *I* statement require no such additional assumption. The result apparently is an unrestricted quantifier logic with respect to its general terms, a logic capable of distinguishing between inferences in which existence assumptions with respect to their constituent general terms are crucial and those in which they are not.

Many scholars have characterized the connection between the Port-Royal theory of immediate inference and the Frege-inspired modern theory of general inference as in part the making explicit in the latter of what was implicit in the former. Given the object-language counterparts of non-empty general terms, it is now customary to say that the modern theory, in contrast to the Port-Royal theory, is 'free of existence assumptions with respect to its general terms'.

There is, however, an important exception to the modern treatment of both *A* to *I* and *E* to *O* inferences, an exception that reduces the impact of the claim often made in favour of the modern theory of general inference over its medieval counterpart, namely, that it has rid itself of existence assumptions with respect to its general terms. Let '*S*' be a general term of the form '(is) the same as *t*', where '*t*' is a singular term. Then both *A* to *I* and *E* to *O* inferences hold unconditionally in

the modern treatment, despite the fact that 'There exists something the same as Vulcan (the putative planet)' is false (because 'Vulcan' refers to no (existent) object). So unless instances of '*t*' in the relevant schemata of modern logic are restricted to singular terms that refer to an (existent) object, the special cases of the unmodified *A* to *I* and *E* to *O* inferences contemplated above will fail. Indeed, this very course of action is reflected in the policy of modern logics that anything of the form:

SE: There exists something the same as *t*,

– which is the object language counterpart of '*t* refers to an (existent) object' – is logically true. In traditional language, the special cases of the unmodified *A* to *I* and *E* to *O* inferences are preserved in the modern theory of general inference by requiring that all statements of the appropriate special forms of *A*, *E*, *I*, and *O* have existential import (with respect to their constituent *singular terms*).

This restrictive policy, however, is *prima facie* no more palatable than the restrictive policy discussed earlier. First it, also, restricts the scope of the modern theory of general inference and thus precludes its use in assessing the validity of inferences containing statements with special empty general terms – for instance, inferences involving statements such as 'All that is the same as Vulcan is in rotation around the Sun' which contains the special empty general term '(is) the same as Vulcan'. Second, the modern theory of general inference does not allow one to distinguish between inferences whose validity requires the instances of the special general term scheme '(is) the same as *t*' in subject position to be non-empty – such as in *A* to *I* inferences – from those whose validity requires no such assumption – such as in *A* to the negation of *O* inferences.

In the modification of the modern theory of general inference called 'free logic' not all instances of the statement form *SE* are logically true, and indeed, some may be false. In the latter case the general term '(is) the same as *t*' is empty – and in fact this is equivalent to asserting that the singular term '*t*' does not refer to an (existent) object. So in free logic the special cases of *A* to *I* and *E* to *O* inferences discussed above are modified to hold on the condition that there exists an object *x* such that *x is the same as t*; no such condition is needed for *A* to the negation of *O* inferences (and vice versa), or for *E* to the negation of *I* inferences (and vice versa).

The principle of the indiscernibility of identicals yields, via quantifier distribution and quantifier confinement,

St

from

For all *x*, *Sx*

on the condition that:

There exists an object *x* such that *x* is the same as *t*.

This restricted form of universal instantiation is the most characteristic feature of a free logic. Indeed, it is easily shown that *SE* is validating just in case unrestricted universal instantiation is validating.

Many philosophical logicians have characterized the relation between the modern theory of general inference and free logic as in part the making explicit in the latter of what was implicit in the former. Given the object-language counterparts of non-empty general and singular terms, it is common to say that free logic, in contrast to the modern theory of general inference stemming from Frege, is 'free of existence assumptions with respect to both general and *singular* terms'.

Because free logics – contra Bertrand Russell – treat expressions such as 'the planet causing the perturbations in the orbit of Mercury' as genuine singular terms, they have yielded new foundations for the theory of definite descriptions (see articles by K. Lambert in *Philosophical Studies*, 1962, 1964, notably "Notes on E! III: a theory of descriptions", *Philosophical Studies*, 1962, 13, 51–9); and, derivatively, for set theory (Scott 1967) and for the theory of partial functions (Lambert and van Fraassen 1972). They have been applied in philosophical

areas as diverse as the philosophy of religion (W. Mann in *Theoria*, 1967) and the philosophy of language (van Fraassen 1969), and have proved especially useful in the analyses of topics in formal ontology such as existence, predication, the theory of objects (Lambert 1983), and abstract individuals (S. McCall in *Dialogue*, 1966). And this list of applications is far from exhaustive.

A technical result of some importance to formal ontology is J. Hintikka's early discovery that contexts of the form

t exists,

where '*t*' is a singular term, are definable by *SE* in most free logics, and the recent companion discovery by R. Meyer, E. Bencivenga, and K. Lambert (1982) that, indeed, unless identity is available, singular existence contexts are *not* definable in what is perhaps the most common formulation of free logic. If the latter is interpreted as a logic of existence this result suggests that in such a theory the bald assertion of Meyer's existence (or the calumny that he does not exist) can only be effected, *sans* identity, by use of the general term 'exists', much tradition to the contrary notwithstanding.

Finally, it has emerged after three decades of study that free logics are compatible with many, often diametrically opposed, world pictures – for instance with the Russellian and the Meinongian world pictures. Their usefulness as a neutral instrument in much ontological argument thus seems assured.

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Logic VII: Ontological Implications

The Commitment Problem. The central problem in the relationship between logic and ontology concerns the ontological implications of logic. It may be called the *commitment problem*:

> To what ontology is one committed by the use of a given logic?

Answers to the commitment problem range widely: there are those (such as Gottlob Frege and Alonzo Church) who believe the use of a suitable logic commits us to an elaborate ontology, while at the other extreme we find Stanisław Leśniewski, for whom logic is ontologically completely neutral. The key figure in the issue is W. V. O. Quine, whose criterion of ontological commitment offers a widely accepted test used in trying to solve the commitment problem (see the article "Ontological commitment").

The commitment problem existed before the advent of modern (Fregean) logic. The 19th-century controversy over the existential import of categorical propositions can be considered an aspect of the commitment problem. It became more complex and ontologically more interesting with the increase in complexity of logic inaugurated by Frege, though he and other pioneers did not see the problem because they thought they were developing the one correct logic. Thus for a time the different ontologies associated with classical logic (Frege's hierarchy of functions, Bertrand Russell's logical atomism, etc.) manifest themselves as disagreements in semantics, much as had happened in the Middle Ages when there was no serious alternative to syllogistic. The problem became obvious with the development of logics alternative to the classical logics of Frege and Russell (multivalent logics,

intuitionistic logic, modal logics, intensional logics, etc.) and with the development of standard techniques of logical semantics.

Higher-Order Quantification. According to Quine's criterion of ontological commitment, when variables other than lowest-order (individual) variables are quantified, the sentences in question must be understood as entailing ontological commitment to entities reified by the quantification. Thus quantification of sentential variables entails ontological commitment to propositions, quantification of predicate variables to attributes, and so on. In view of the uncertainties surrounding the identity conditions of such entities, Quine rejects higher-order quantification. In order to obtain expressive power sufficient for science, he prefers to be committed to sets, which have extensional identity conditions.

Quine tends to restrict the term 'logic' to first-order predicate logic, so supporting the ontological neutrality of logic (except that he rejects universal logic (see below) on convenience grounds). His insistence that the entities ranged over by non-individual variables are intensional may be questioned: for Frege, the functions over which higher-order variables ranged have extensional identity conditions. Of those who wish, for whatever reasons, to incorporate higher-order quantification into their logics, some embrace the ontological commitments involved, while others seek to avoid unwanted commitments, for example by recourse to the substitutional interpretation of quantifiers.

Existential Import of Terms. The categorical syllogisms taken as valid by Aristotle are all valid only on the assumption that the general terms occurring in them are not empty. It follows that not all of Aristotle's valid moods are valid if interpreted on an empty universe, so that acceptance of Aristotle's syllogistic entails commitment to the existence of at least one thing. This is the minimal ontological commitment: there is something (rather than nothing). The requirement of existential import (non-emptiness of terms) was abandoned in the logical reforms of Franz Brentano and John Venn (1834–1923), reducing the number of valid moods. With the advent of modern predicate logic, the traditional logic of terms fell into disuse, and the kernel sentence form became that of a predicate combined with one or more singular terms.

In the works of the pioneers, Frege and Russell, while predicates could be empty (true of no individual), singular terms had to denote, so existential import returned for singular terms. Apparent counterexamples were dealt with differently: Frege accepted that singular terms in natural languages were often empty, but regarded this as a defect and in his logical language attempted to ensure (abortively, since his system was inconsistent) that all terms denote. Russell preferred to show that complex singular terms – definite descriptions, complex class and relation terms – are only apparent logical units, and dissolve on a proper logical analysis. Apparently simple empty singular terms are implausibly claimed to be disguised descriptions, leaving only very few 'logically proper names'. Both Frege and Russell thus lose the ontological neutrality of Brentano and Venn, though Russell later came to view the theoremhood in *Principia Mathematica* of "Something exists" as a "defect in logical purity".

Free Logic. A logic whose theorems remain true on the empty domain is called a *universal* logic. The modifications to classical predicate logic required to ensure universality are minor though slightly inconvenient. By contrast, admitting empty singular terms into logical theory requires a more thorough adjustment if the quantifiers are interpreted objectually. This results in a free logic, which is to say a logic in which unbound singular terms (whether simple or complex) are allowed to retain their status as genuine terms even though they may be empty (free of existential import). It is natural, but not necessary, for a free logic to be universal. There are numerous free logics, differing among other things in the way they treat atomic sentences containing empty terms: some allow such sentences to be true (positive free logics), others make all such sentences false (negative free logics), yet others admit truth-value gaps for such sentences. (For a summary, see Bencivenga 1986.) Free logics unite in rejecting the classically valid

inference '*a Fs*, therefore something *Fs*' in favour of the weaker '*a Fs*, *a* exists, therefore something *Fs*'.

The introduction of free logics allows the restoration of some of the neutrality lost under Frege and Russell. However, the neutral tradition did not go under completely with the advent of modern logic: many of the freedoms rediscovered in free logic were already present in the logical systems of Leśniewski, whose ontology combines features of the traditional logic of terms (in the form of Ernst Schröder's algebra of logic) with the logical innovations of Frege. Leśniewski retains general terms, allowing them to be empty, and has no syntactically separate category of singular terms. His quantifier laws are however the same as those of Frege and Russell: in particular the inference '*F(a)*, therefore for some *b*, *F(b)*' is accepted as valid, even though an empty term may be substituted for '*a*'. It is a theorem of ontology that for some *b*, no *b* exists. So 'for some *b*, *F(b)*' cannot mean 'there exists *b* such that *F(b)*'. However quantification is to be interpreted in Leśniewski – and there is no consensus on this – it cannot be objectually, unless one is prepared to accept non-existent objects, which Leśniewski was not.

Possibilia. One may admit the objectual interpretation of quantifiers, keep the semantics simple, and provide referents for (apparently) empty terms by admitting *non-existent* objects as their referents. This view is notoriously associated with Alexius Meinong, though his innovation consisted solely in accepting impossible objects in addition to possible ones. The latter had been commonplace since the Middle Ages, notable exponents being John Duns Scotus and Leibniz. Logicians have felt compelled to admit pure possibilia and even on occasion impossibilia in order to account for the validity of inferences concerning modality and intentionality, both areas which had been suppressed or neglected during the early rise of modern mathematical logic.

An ontologically straightforward account of the meaning of modal sentences which follows their now standard algebraic semantics envisages a number of entities known as possible worlds, of which only one (ours) is actual. In most modal predicate logics, these worlds are inhabited by individuals, some of which do not exist in the actual world. It is a matter of considerable disagreement in the philosophy of modal logic how far one is ontologically committed to such possible worlds and their purely possible denizens. The most extreme realist position, that of David Lewis, takes all possible worlds and their inhabitants to be equally real, existing independently of mind and language. The term 'actual', used by us to distinguish our world, is an indexical expression on a par with 'here' or 'now', and is of no ontological significance. Lewis, like Leibniz, though for different reasons, denies that any entity is to be found in more than one world: there is no transworld identity. The most one may find in another world is a counterpart of an object *a*, the object in that world most like *a*. Most philosophers who accept possibilia prefer to accept transworld identity, taking there to be as it were a common pool of possible objects, selections from which exist in different worlds.

The ontological commitment to possibilia facilitates a simple referential semantics of terms, with the addition of a world-relativ existence predicate and the relativization c truth to worlds. Quantification can be either possibilist, variables ranging over all possibilia, or actualist, ranging only over those objects actual in the world in question. Most philosophers are wary of pure possibilia, attempting to provide accounts of the truth of modal statements without accepting them, a position called *actualism*, and upheld, e.g., by Robert Stalnaker and Alvin Plantinga. Ways around accepting possibilia usually involve other ontological commitments, for example to propositions and concepts, or to attributes and states of affairs. In this way commitment in one area (possibilia) is traded for commitment in another (abstract entities, intensions).

Options. Given a standard Tarskian semantics and acceptance of Quine's criterion of ontological commitment, differences of expressive power of a language may be aligned with differences in ontology, e.g. with respect to universals (cf. Cocchiarella 1986). As extremes, we have the rich higher-

order intensional logic of Church with its hierarchies of extensional and intensional entities, versus the first-order logic of Nelson Goodman and his world consisting of individuals only. In each case the richness of the logic and the richness of the ontology are in proportion. However, by making the semantics more complicated – e.g. through use of contextual elimination of terms (Russell), empty terms (free logic), senses (Frege), substitutional semantics (Hugues Leblanc) – it may be possible to reduce ontological commitments without corresponding loss of inferential and expressive power. An illustration of such alternative semantics for the case of modal predicate logic is provided by John Bacon ("Four modal modelings", *Journal of Symbolic Logic*, 17 (1988)).

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Logical Atomism

Logical atomism is a metaphysical doctrine to the effect that the world consists of 'logical atoms', i.e. of elements or parts such that none entails the presence of any other. Thus logical atoms are marked by their mutual independence or separability, not – as in the case of the physical atoms of the Democritean tradition – by their indivisibility. The term itself was coined by Bertrand Russell in his "The philosophy of logical atomism" (*Monist*, 1918) to set off his own position from that of the British Hegelians, like F. H. Bradley (1846–1924) or Bernard Bosanquet (1848–1923).

The opposite doctrine is *absolute monism*. It says that the world is a tightly knit whole in which each part entails the rest: the world is a single logical atom. Hence to know anything one should know everything. Among the absolute monists were Parmenides, the Stoics, Spinoza, and Hegel.

Russell interpreted his logical atoms as 'particulars', describing them as follows:

> Particulars have this peculiarity . . . that each of them stands entirely alone and is completely self-subsistent. That is to say, each particular that there is in the world does not in any way logically depend upon any other particular. Each one might happen to be the whole universe.

Originally, he took his logical atoms to be 'sense-data'; later he identified them with 'events'. He believed, moreover, that the independence of logical atoms presupposes their absolute simplicity. This accounts for much of the confusion in his statement of the logical atomist position.

In philosophy, logical atomism is represented mainly by two books: David Hume's *Treatise of Human Nature* and Ludwig Wittgenstein's *Tractatus Logico-Philosophicus*. Russell's version derives from both. (A forerunner of logical atomism in the 14th century might have been Nicholas of Autrecourt (*c.* 1300–*c.* 1350), 'the medieval Hume', but this is disputable.)

In Hume the logical atoms are 'perceptions', with regard to which he puts forward the maxim: *whatever is distinct, is separable*. He tries to establish it by citing three further principles:

1. whatever is distinct, is distinguishable;
2. whatever is distinguishable, is separable by the thought or imagination; and
3. whatever we can imagine, is possible.

The first is Leibniz's law of identity. The second he calls "the principle of the liberty of the imagination", taking the third to be "an evident principle". Granting these, the maxim follows.

Hume's maxim looms large in his *Treatise*, but it is missing in his *Enquiry*. Still it is at the heart of his critique of causality. The cause is one perception, the effect is another; and they are distinct. Hence, by the maxim, they are separable, and this means that one might occur without the other. Or as he puts it: "any thing may produce any thing".

In Wittgenstein the logical atoms are either the 'atomic facts', or the 'atomic situations' (*Sachverhalte*), the former defined as the holding of the latter. His principle of logical atomism is stated most generally in theses 1.2–1.21: "The world splits into facts. Anything may be the case or not, the rest staying the same". It is most specific in theses 2.061–2.062: "Atomic situations are mutually independent. Neither the holding, nor the not-holding of one may be inferred from that of another". And it is at its strongest in thesis 4.27: "Any combination of atomic situations may hold, with none of the rest". Yet another variant, following from 1.21, is 5.135: "There is no way to infer the holding of a situation from that of a quite different one".

The gist of logical atomism are the ideas of independence and separability. These are best explained in terms of possible worlds. Two logical atoms are separable if in some possible world one occurs without the other. And they are independent if there is also a world in which they occur together, and a world in which neither does. 'Possible worlds' are present both in Hume and Wittgenstein. In Hume they are 'minds', defined as 'heaps of perceptions'. And in Wittgenstein they are the "truth-possibilities of elementary propositions".

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Logos

This term is sometimes misleadingly translated as 'word'. λόγος never means 'word' in the sense of the basic linguistic unit, the lexeme. It is a noun corresponding to the verb λέγειν 'say, speak'; it denotes a meaningful utterance (i.e. 'speech') ranging from a sentence to a whole spoken discourse. The term from an early time could also signify a reckoning or a proportion. By extension it came to mean also 'account', 'argument', and the faculty of reason.

Heraclitus first made philosophical use of the term to designate the unifying structure of the universe which manifests itself in the orderly arrangement of parts and the constant proportion of elemental transformations (fragments 1, 30, 50). This order is accessible to cognition, but people are ignorant of it (fragments 1, 2, 89). In Heraclitus' theory λόγος becomes an inherent structure of the cosmos corresponding to a structure of thought and verbal expression, and hence a principle closely associated with reason.

The Sophists were much interested in the art of λόγοι, especially the strategy of argument and the techniques of persuasion. More directly philosophical advances were made by Plato, who broke down the sentence or statement (λόγος) into parts of speech and explained the conditions of their meaningful combination (*Sophist* 261–3). He found that thinking (διανοῖα) was silent speech (λόγος), a dialogue with oneself. Here λόγος and rational thought become almost synonymous.

In the *Categories* (2, 4) and the *De Interpretatione* (1–6), Aristotle builds on Plato's account of λόγος, and he then goes beyond all his predecessors in working out a theory of argument (συλλογιστική). In his moral psychology Aristotle recognizes a part of the soul that has reason (λόγος) and a part that does not. The part with reason is further divided into a theoretical and a calculative or deliberative part (*Nic. Eth.* 1139a3ff.).

For the Stoics λόγος became a common principle of reason in man and the universe, the source of both moral and physical order. It was identified with God in theology, with 'artistic' or creative fire in cosmology, and was manifested as πνεῦμα, a mixture of air and fire, in physiology. The presence of reason in the universe allowed one to see goodness and purpose in all nature and history.

In middle Platonic thought, notably in Philo of Alexandria (*c.* 20BC–AD54), λόγος became associated with a creative principle

subordinate to God or the One. On this view λόγος is not an immanent principle as in Heraclitus and the Stoics but a distinct reality. The identification of Christ with the Word in the Gospel of John (which may be relying on Hebrew rather than Greek sources) encouraged a further extension of this middle Platonic notion in Christian philosophy and theology. In Neoplatonism Plotinus (*c.* 205–70) viewed λόγος as an emanation from Mind and Soul.

Despite the diversity of its philosophical interpretations, the concept of λόγος continued throughout its history to express a deeply held Greek conviction that the cosmos was orderly in a rationally comprehensible way.

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DANIEL W. GRAHAM

Lotze, Rudolf Hermann

Rudolf Hermann Lotze was born in Bautzen in 1817 and died in Berlin in 1881. After taking doctorates in both medicine and philosophy from Leipzig, he became instructor in medicine there in 1841 and in philosophy soon afterwards. In 1844 he succeeded Johann Friedrich Herbart as professor of philosophy at Göttingen, where he remained until 1881, when he moved to the University of Berlin – only to die of pneumonia a few months later. Although strikingly different personality types, Lotze and Franz Brentano were very similar in their rejection of speculative system building, in their insistence on rigorous, detailed attention to matters of fact as well as concepts, and in their attempts to develop a world view at once epistemologically realistic and metaphysically spiritualistic. While both attracted as students an astonishingly high percentage of the best younger minds of their day, neither generated a philosophical movement under his name. It is, none the less, arguable that Lotze was the single most influential German philosopher of the last half of the 19th century. Reading German and Anglo-American philosophy from this period, and well into the 20th century, one is amazed at the number of dedications and other indications of profound debt which Lotze receives. In Germany, Carl Stumpf and Gottlob Frege were his students, and – though not his student – Edmund Husserl was deeply influenced by him on crucial points. James Ward (1843–1925) in England, and Josiah Royce (1855–1916) and Borden Parker Bowne (1847–1910) in America, were all greatly indebted to Lotze, and effectively passed his influence on to the next generation of Anglo-American philosophers (see Kuntz 1971, pp. 3–94).

Lotze took the main purpose of philosophy to be harmonization of the intellectual and practical (moral, aesthetic, religious) interests of man, but was sure this could not be accomplished by derivation or speculative construction from some simple or homogeneous set of principles. An 'analytic' philosopher before the time, he made assertions which became more tentative as they grew in inclusiveness, and he attributed the cultural chaos of modern existence to the intellect's attempt to claim exclusive domain, in the interpretation and guidance of life, over all our interests including our "vague beliefs and unquiet yearnings". Theorizing is always restricted to what we have ideas of. Ideas are only one component of our mental life, and they are neither identical with, nor exhaustive of, nor inseparable from their objects. His position on the ontological separation, the distinctness in nature, of the idea as such and its object was based upon insight into the character of ideas over against their objects (*Logik*, Leipzig, 1874, III, 1). Moreover, he did not regard the fact that ideas and objects are inherently separable as any reason for general scepticism. Ideas serve very well within the confines of their nature to represent to us things as they are, within limits. But they are never used except as supplemented by a conative apprehension of larger total fields of objectivities within which they do their work of selecting and ordering. This conative apprehension (feeling, volition) is

the part of human reason that brings us into correct relationships with being and life in general. It directs us by feelings of pleasure or pain toward the Good in all its forms: intellectual, aesthetic, moral and religious, among which the intellectual good (truth) plays a subordinate role restricted by the extent of our ideas.

Substantial being derives from teleological unity, the unity of an unfolding purpose. We know such unity and being in ourselves by direct feeling, and extend it by analogy to other substances which appear to us. For the traditional reason that nothing can survive the passage between substances, transitive causality is regarded as impossible; so the observed causal influences of one substance upon another can only be real if those substances are parts of more inclusive substances and the causation involved is in fact *causa immanens* (*Metaphysik*, Leipzig, 1879, I, 5; *Microcosmus*, Leipzig, 1856–64, IX, 1, 5).

Since both heart and action naturally find greater rest and integration in a comprehensive causal totality within which one may coherently pursue the Good, Lotze believes we are justified in adopting a teleological or spiritualistic monism as our general outlook on being, though we cannot *prove* that we are correct in doing so (*Metaphysics* I, 7, 4). But this is not one of those monisms in which the individual is lost or becomes unreal, and hence Lotze naturally became a fundamental source for the personalistic schools of the late 19th and early 20th centuries. The key here is his interpretation of what it is to be. He rejects the traditional association of being and independence. To be is to be in relationships (*Microcosmus* IX, 1, 30). The relations need not have substances as their terms, but can also hold between more abstract entities. Substances *endure*. But events, which do not similarly endure, none the less *occur*, and hence have *actuality* (*Wirklichkeit*). Propositions, which neither endure (exist through time) nor occur at a time, have *validity* (*Geltung*), a mode of being which Lotze extends also to concepts and relations, and even to tones unheard and colours unseen (*Logic* III, 2). The influence of this view upon Frege's and Husserl's doctrines of objective realities which are neither individual entities nor events was very great. But all of these types of beings are subject to relational frameworks, and such subjection is what their being is.

In separating being from dependence, Lotze touches upon one of the most fundamental points in historical and systematic ontology, recasting in consequence a wide array of traditional concepts and issues. Not only, as already noted, does he thus make possible the retention of truly individual selves within a larger personal totality upon which they depend, but his treatment of space and the spatial world as a phenomenal counterpart of interactions between such selves does not, as in Leibniz, imply that world's nonreality (*Metaphysik* II, 1, 130). In general, the issues concerning 'realism' are transformed by this profound reinterpretation of what it is to be, as is also seen in his exposition of Plato's 'Ideas', so significant for Husserl and the rise of 20th-century phenomenology.

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DALLAS WILLARD

Lull. See: Raymond Lull

M

Mach, Ernst

Ernst Mach, physicist, physiologist, and philosopher of science, was one of the main figures in the late 19th-century revival of empiricism. He contributed to the rise of logical positivism, as well as exercising influence *inter alia* on Albert Einstein (1879–1955).

Mach was born on 18 February 1838 in Chirlitz (Chrlice) near Brünn (Brno) in Moravia, and died on 19 February 1916 at Vaterstetten near Munich. His father was a teacher turned farmer who educated Ernst at home in a liberal, anti-clerical atmosphere. Mach spent little time at school, where he showed an aversion to religion and classical languages and was advised to take up a trade. This he did, studying joinery, a skill which stood him in good stead later as an experimental physicist.

Mach studied physics and mathematics at Vienna University from 1854, wrote a doctoral dissertation on electricity, and attained his habilitation in 1861. To supplement his meagre income Mach began giving private tuition, especially to medical students, for whom he also produced a physics textbook. Contacts with physiologists aroused his interest in sensory physiology, and the connections between physics and physiology remained his chief fascination. In 1864 he took up a chair of mathematics in Graz, two years later becoming professor of physics there. At this time he wrote a book for musicians on the theory of music of Hermann von Helmholtz (1821–94).

One of the most influential of Mach's ideas was his theory of muscular sensations, presented in the paper "Bemerkungen zur Lehre vom räumlichen Sehen" of 1865, which later prompted Christian von Ehrenfels to develop the notion of a Gestalt quality and thereby led also to the development of Gestalt theory in Berlin and elsewhere.

In 1867 Mach married and moved to a chair of experimental physics at the University of Prague. This suited his mixture of talents ideally, and he produced works on optics and accoustics, and on sensations of movement, and a historical monograph on the principle of conservation of energy in which he first formulated his principle of economy of thought (*Denkökonomie*). This, a version of Ockham's Razor, demands the rejection of all unnecessary entities in science and the reduction of laws to a minimum sufficient number. In 1883 he published his *The Science of Mechanics: a Critical and Historical Account of Its Development*, in which he criticized Sir Isaac Newton's formulations of the laws of mechanics, and laid the basis for Einstein's relativity theory. Mach believed that science had the role of providing a shortcut in the form of a minimal number of principles enabling one to infer from the existence of certain sensations the likely existence of others. Scientific hypotheses or statements which do not admit of verification on the basis of sensations are to be rejected as meaningless; and intermediate, unobservable entities which are postulated by science are to be rejected by the principle of economy mentioned above. This strong verificationism and Berkeleian phenomenalism was wielded by Mach in particular against the atomic hypothesis and against Newton's theory of absolute space and time. Newton's famous revolving bucket example, in which the motion of water in a rotating bucket is cited as evidence for absolute (rotational) motion, is rejected by Mach, since he contends that the motion of the water can be assumed to be due to the presence of distant matter (the fixed stars). What came to be called Mach's Principle states that the inertia of a body – its resistance to being accelerated – is not an intrinsic property of the body but a result of its relationship to the rest of the matter in the universe.

Mach's major philosophical work, *Contributions to the Analysis of Sensations* (1886), was important for the later empiricism of Bertrand Russell, William James, and the Vienna Circle, the latter naming their official society the *Verein Ernst Mach* in his honour. In psychology Mach, like David Hume, rejected the self as a mental substance, he likewise rejected Kant's unknowable *Ding an sich*. Causality as a mysterious unobservable link is to be rejected: in its place Mach emphasizes the tabulation (usually in the form of differential equations) of functional relations among continuously varying measurable quantities discernible in experience. Rejecting both bodies and souls, Mach evaded the mind–body problem with the idea of neutral monism, according to which both the physical and the mental are reducible to different groups of sensations. Mach stood up for the social importance of natural science and for the unity of all science, a later catchword of the logical empiricists.

While in Prague, Mach studied sound, especially the Doppler effect, and developed methods enabling him to photograph bullets travelling faster than sound. The conical shock waves thus observed for the first time are responsible for the now familiar double boom of supersonic aircraft. From this research we have the so-called Mach numbers, through which Mach's name is also popularly known. The Mach number gives the ratio of the speed of fluid flow past a body in a fluid medium to the speed of sound in that medium, thus Mach numbers less than 1 represent subsonic flow, those greater than 1 supersonic flow.

In 1895 a chair of philosophy with special reference to the history and theory of inductive sciences was created for Mach in Vienna. What should have been the pinnacle of his career was cut short after two years by a crippling stroke, and Mach applied for retirement in 1901. He was given a seat in the upper chamber of the Austrian Parliament, though he declined a title. Mach had long been friendly with Viktor Adler (1852–1918), the founder of the Austrian Social Democratic Party, and took pains to vote for important progressive legislation. Mach was also a supporter of school reform and workers' education, contributing several series of popular scientific lectures. His combination of modern scientific views and socialism brought him a considerable following in Russia, to the extent that Lenin felt compelled to denounce him in print in his *Materialism and Empirio-Criticism*.

Mach's mental powers were unaffected by his disablement and he was able to continue writing using a special typewriter, producing his last major work *Erkenntnis und Irrtum* (1905) and an autobiography (1910). His *Principien der physikalischen Optik* appeared posthumously in 1921, edited by his son Ludwig and with a foreword, said to be by Ernst Mach, fiercely criticizing Einstein's relativity theory. The authenticity of this foreword, and of a similarly critical quotation from Mach in Ludwig's foreword to the 1933 edition of the *Mechanics*, has been seriously questioned. Another controversial question about Mach's later views is whether, having earlier rejected all ideas of substance as empty metaphysics, he later came, on the basis of the visual evidence afforded by new instruments, to accept the existence of atoms.

Although he called himself a physicist, and he was an experimentalist of considerable gifts, Mach's strongest influence was in the philosophy of science and methodology. Later in life, his rejection of atomism left him relatively isolated among physicists of the next generation such as Ludwig Boltzmann (1844–1906) and Max Planck (1858–1947); and Einstein, perhaps under the influence of the critical foreword, toned down his praise for Mach in the 1920s, at the time when Mach's influence on philosophers such as Russell, Moritz Schlick (1882–1936), and Otto Neurath (1882–1945) was at its height.

Mach's phenomenalism and anti-metaphysical stance are now generally regarded as outmoded, but his overall influence on 20th-century philosophy has been considerable. His influence was not confined to science, philosophy, and politics: the novelist Robert Musil (1880–1942), who wrote a dissertation about Mach, incorporated Machian elements into his writings, while the artistic movement of Viennese Impressionism owed much to Mach's phenomenalism.

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PETER M. SIMONS

McTaggart, J. M. E.

James McTaggart Ellis McTaggart (1866–1925) was the author of four books intended as commentaries on, or developments of, the Hegelian dialectic of which he was a committed but eccentric devotee. However, when he finally set about his own main work of positive metaphysical construction, *The Nature of Existence* (2 vols., 1921 and 1927), he used a strictly deductive method. Volume 1 claims to deduce some absolutely certain abstract conclusions about the universe from

self-evident truths together with the empirical premisses that something, and more than one thing, exists. Volume 2 claims to show that a particular more concrete description of the universe is almost certainly true, as the only one available in accordance with those conclusions. His main conclusions are:

1. that nothing is physical;
2. that the universe is composed of spirits or selves each passionately in love with some of the others and none unloved; and
3. that time is unreal and there is no such thing as change.

These invite the (in most cases ill-founded) charge that metaphysical systems are at bottom merely comforting fantasies. However, McTaggart was peculiarly insistent in his condemnation of wishful thinking and had an unparalleled battery of brilliant arguments for his viewpoint.

The unreality of matter and spiritual nature of the universe is arrived at mainly as an inference from some conclusions about substances and their parts:

1. Anything is a substance which has characteristics and is not itself a characteristic or fact.
2. It is self-evident that every substance is infinitely divisible and thus contains an infinite number of other substances as its parts. A 'set of parts' of a substance is a collection of its parts which make up the whole 'content' (as it were matter or stuff, though not necessarily, and, in the end, necessarily not, in a physical sense) of the substance and do so non-redundantly (as including both Scotland and Dumfries, or both Scotland and Dumfries-and-Cumberland, among the parts of Britain fails to do). There will always be infinitely many alternative such sets representing different ways of carving the substance up in thought.
3. In virtue of a principle of "the dissimilarity of the diverse" (badly named by Leibniz "the identity of indiscernibles") there must be a sufficient (that is unique and purely general) description of every substance.
4. It follows, by an elaborate chain of argument, using the further principle that things must be whatever they are in a definite fashion, that the universe must have a set of 'primary' parts sufficient descriptions of which imply sufficient descriptions of all 'smaller' parts, and that this can only hold if there is a relation of 'determining correspondence' between that set of parts and all sets of parts of those parts, which means, very roughly, that the set of primary parts is articulated into an infinite series of ever smaller maps of itself. (Josiah Royce used a similar argument for his version of absolute idealism.)
5. A universe containing matter could not have primary parts in this sense and is thus impossible, while a spiritual world, with selves as its primary parts, and their perceptions of each other and of themselves as their parts, is the only world we can conceive which could do so, and it is therefore almost certain that that is what the actual world is.
6. The perceptions each of these selves contain of each other must be of an intimacy such as to make them instances of love, though love often misperceived as something else (e.g. as awareness of a physical world).

The timelessness of the universe follows from McTaggart's celebrated proof of the unreality of time which is currently, unlike his other arguments, still much debated. The reality of time, he claims, requires not only that events constitute a series determined by the earlier–later relation (the B series) but also one determined by the presentness or degree of pastness or futurity of each event (the A series). The B series without the A series would provide no real change, just a standing system; moreover, the earlier–later relation requires definition through the A series predicates. Yet the A series is impossible, for the predicates (past, present,

and future) determining it are both mutually incompatible and purportedly each true of every event. It is an illusion to think the contradiction can be avoided by saying that they do not all apply now but only will or did apply – for 'now' means 'at a *time* which is present', and *this time* has not yet been liberated from the contradiction of possessing the predicates 'future' and 'past' as well. Time then both requires, and is shown to be unreal in virtue of the self-contradictory nature of, the A series. The appearance of time must be the appearance, however, of some genuine non-temporal layout of events (the C series) and McTaggart's suggestion is that each timeless spirit contains a system of Chinese box-like parts one inside another, each a seeming moment of its life (or rather of a series of lives – for McTaggart believed, *sub specie temporis*, in reincarnation) such that the containing parts experience the contained as their past and anticipate what contains them as their future. Thus the self as a whole, for the other members of the C series, lies at the end of time while for itself and in truth it is their timeless consummation. (The articulation of the self into the set of parts which form the C series does not coincide with any of the sets of parts in virtue of which it satisfies the determining correspondence requirement, but represents a quite different principle of division. Here and elsewhere the imagery behind the system often seems remarkably spatial.)

Even those philosophers for whom this system seems too extravagant to arouse serious interest should be impressed by much of the excellent treatment in Volume 1 of such things as substances or particulars, qualities, relations, facts, groups, propositions, possibilities, causation, counterfactuals, and truth. This is much closer to the work of his Cambridge colleagues, G. E. Moore and Bertrand Russell, than to such other main Anglo-American idealists as F. H. Bradley (1846–1924) and Bernard Bosanquet (1848–1923). And there is little in common, too, between the usual absolute idealist conception of the Absolute or Universe as a self-experiencing One and McTaggart's conception of it as a society of persons.

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TIMOTHY L. S. SPRIGGE

Maimonides. See: Moses Maimonides

Malebranche, Nicolas

Nicolas Malebranche was born in Paris in 1638 and died there in 1715. He was educated in scholastic philosophy, spending three years at the Sorbonne. He entered the Oratory in 1660 and was ordained a priest in 1664. The Augustinianism typical of the Oratory was one of the two main influences on his philosophy. The other began with a chance discovery in 1664 of Descartes's treatise *L'homme*. His first, longest, and most important work is *De la recherche de la vérité*; its first edition appeared in 1674–5, with subsequent editions containing many *varia*, the sixth and last in 1712. His career was marked with polemic on a variety of philosophical topics, with Simon Foucher (1644–96) and Leibniz, for example, and, most notably, with Antoine Arnauld (1612–94).

Malebranche's ontology is largely derived from his two principal sources, Augustine and René Descartes. From the former he inherits the radical dependence of all things on God, which he reflects with his celebrated doctrine of occasionalism. To the latter he owes his doctrine of essences, according to which everything with the exception of God is either thought (mind) or extension (body). The two sources are not entirely disparate. Throughout the latter part of the 17th century the Christian orthodoxy of Cartesianism was argued by many on the basis of the appearance in Augustine of such views as the mathematical conception of nature, innate

ideas, the *cogito*, and even the mechanical soul of animals.

Malebranche holds that everything is either substance or mode. Despite his terminology, Malebranche departs in very important ways from the Aristotelian tradition of substance. For one thing, there is no real difference between a mode and the substance of which it is the mode; a mode is the substance existing in a certain way – for example, the shape of a round thing is that very thing existing such that all the points on its surface are equidistant from its central point. Thus, there cannot be real accidents. In addition, the traditional relation of inherence between substance and accident is replaced by the relation of deducibility. The various shapes, for example, that extension or body may take, stand to extension as the theorems of geometry stand to the axioms and postulates. This is the ontological explanation of why Malebranche rejects substantial forms, which involve occult qualities like levity, and instead appeals to mechanical explanations, which require only the evident ideas of mathematics.

The concept of substance employed by Malebranche comes from Descartes, who defined substance as that which needs nothing other than God in order to exist. The criterion for such independence is the conceivability of substance apart from everything else. However, since Malebranche subscribed to the Cartesian view that matter is both infinitely divisible and infinitely extended, and also held that every part of matter is conceivable apart from every other part, he must also hold that every substance contains and is contained by an infinite number of other substances. This suggests that what counts as a substance depends on how we conceive the world. The tacit suggestion that substance is a category of conceptualization rather than a status of being is only one of several ways that Malebranche anticipates Kant. On the other hand, since nothing is ultimately conceivable apart from God, Malebranche is faced with the problem of showing just how he differs from Spinoza's view that God is the substance of the world. In the last polemic of a polemic-filled life, Malebranche debated this issue with Dortous de Mairan (1678–1771).

However problematic their status as substances, there are analogies between minds and bodies that Malebranche exploits in explicating both. Matter has two main properties. The first is its passive capacity for receiving different shapes. These are of two sorts: external figure, e.g. the roundness of a piece of wax, and internal figure or configuration, e.g. the figure of its minute parts that make the wax what it is. The former may change, but not the latter, without significantly altering the wax. The second main property of matter is its capacity, also entirely passive, for being moved. God need not create motion in matter, but without it there would be no variety in the world. Minds also have two main properties. The first of these is their passive capacity to receive different kinds of perception, which Malebranche understands generically to include all awareness. These in turn are of two sorts. Corresponding to configuration in matter are sensations like pain, which affect it significantly. The analogue in the mind to external figure in matter is pure perception. In the typical case of such perception, the mind unaffectedly contemplates the ideas of things. Corresponding to motion in matter is the mind's impulse, which allows the will to be active in a problematic sense.

Just how to analyse ideas was the topic of Malebranche's dispute with Antoine Arnauld, who held that ideas are modes of the mind. For Malebranche, however, some of our ideas have features, like infinity and universality, which entail that they cannot be modes of the mind, which is finite and particular. While sensations may be modes of the mind, ideas can only be the exemplars after which God creates the world. The ontology involved here is difficult to explain and requires Augustinian elements, like the great chain of being, that are fundamentally at odds with Cartesianism; one indication of this is that Malebranche was forced to deny the creation of the eternal truths. On the other hand, this ontology is required by his doctrine of the vision of all things in God – the mind's immediate object in the perception of a material thing is that thing's intelligible component, viz. its exemplar in God.

Dependence on God is not only cognitive

but also causal. Malebranche employs several arguments to show that only God can be a real cause. Material things cannot cause our ideas of them, for example, because this would violate the axiom that an effect cannot be greater than its cause, and because a real cause must be conscious of its effect and the manner of its production. This kind of argument shows that occasionalism was not invoked as an *ad hoc* explanation of mind–body connections, which far from being the *explananda*, were *prima facie* counterexamples to the doctrine. Instead, Malebranche intended the doctrine as a general analysis of causation that requires a necessary connection between real cause and effect. With constant conjunction as the only relation between occasional causes and effects, Malebranche thus anticipates David Hume.

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THOMAS M. LENNON

Mally, Ernst

Ernst Mally was born in Krainburg (modern Kranj, Yugoslavia), on 11 October 1879. After the death of his father, Mally's mother moved the family to Laibach (Ljubljana), where in 1890–8, Mally attended the Gymnasium, from which time his early interest in philosophy can be dated. In 1898 Mally attended the University of Graz in Austria, where he studied physics and mathematics, and later became a student and lifelong collaborator of Alexius Meinong in philosophy and experimental psychology.

Mally received the degree of Ph.D. in 1903, and taught at the *Mittelschule* in Graz from 1906, and at the university from 1913. When Meinong died in 1920, Mally took over the laboratory for experimental psychology which Meinong had founded. In 1921 he received the title of *ausserordentlicher* professor, in 1923 he became *ausserordentlicher* professor of philosophy, and in 1925, *ordentlicher* professor of philosophy, signalling his emergence as Meinong's intellectual successor at the university, where he held the same chair until 1942. He died on 8 March 1944.

Mally's contributions to philosophy fall into three main categories. He made significant advances in the theory of objects or *Gegenstandstheorie* originated by Meinong, developed an ontologically neutral predicate theory in mathematical logic, and produced the first axiomatic system of deontic logic in formal value theory. Mally's influence on Meinong's mature formulations of object theory is so extensive that it is sometimes difficult to separate Meinong's ideas from Mally's. Meinong credited Mally with the distinctions and arguments he consciously adopted, and during the period of their collaboration Mally lent his logical and mathematical acumen to Meinong's less formal elaborations of object theory, intentional psychology, and value theory.

To give but one indication of his impact on Meinong's philosophy, Mally was responsible for the distinction between *konstitutorische* and *ausserkonstitutorische Bestimmungen* (in J. N. Findlay's (1903–87) rendering, nuclear and extranuclear properties), renamed from Mally's distinction of *formale* and *ausserformale* properties. Without this crucial distinction, an object theory logic cannot preserve consistency in light of such challenges as Bertrand Russell's problem of the existent round square. The most profound statement of Mally's understanding of object theory undoubtedly occurs in the first chapter of his long essay "Investigations in the object theory of measurement", appearing in Meinong's 1904 anthology, a principal source for Graz School philosophy. Mally further brought his logical prowess to bear on the problem of whether there can be unapprehendable or mind-independent objects of thought, a position which Meinong had held without supporting argument. In his

essay, "On the objects' independence from thought" (1914), Mally opposed idealistic psychologism in object theory, and endeavoured to show by a diagonal argument that self-referential thought is logically absurd, and that therefore objects of thought cannot be merely objects *as* apprehended. He postulated an ascending hierarchy of orders of objects and legitimate totalities of objects on the model of Russell's ramified theory of types, by which he hoped to maintain a general science of objects despite paradoxes in the naïve unstratified theory. Mally's paradox inspired Meinong's theory of defective objects in his *On Emotional Presentation* (1917), according to which certain thoughts are not intentionally directed toward any objects.

Mally later began to diverge from the spirit of Meinong's semantics by offering another distinction between dual modes of predication involved in attributing properties to existent versus non-existent objects. According to this distinction, the golden mountain is not really gold in the same way or precisely the same sense as an existent gold watch is actually gold. Mally proposed the dual modes of predication distinction in order to avoid conceptual difficulties in object theory, but since the distinction contradicts the independence of *Sosein* from *Sein*, a thesis at the heart of Meinongian object theory, Meinong was never able to accept it. This departure from the common core of Meinong's principles, by which the golden mountain is gold in the very same sense and to the same extent as any existent gold entity, marks the beginning of Mally's independent formulation of a strictly non-Meinongian predication theory for existent and non-existent objects.

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DALE JACQUETTE

Many-Valued Logic. See: Logic IV

Maritain, Jacques

Jacques Maritain (1882–1973) was a French philosopher who, with Etienne Gilson, led the revival of Thomism in the 20th century. He applied the principles of Thomas Aquinas's metaphysics and ethics to problems of contemporary epistemology, politics, aesthetics, and ethics in such a way as to influence generations of Catholic students in the revival of Christian philosophy. His political writings are judged to have had a significant impact on the formation of Christian Democratic parties in Europe and South America after World War II.

Maritain was initially depressed with the positivism of the Sorbonne. However, through the lectures of Henri Bergson at the Collège de France, his hopes for the possibilities of metaphysics were revived, and, influenced by the novelist Léon Bloy, he was converted to Catholicism in 1906. Only later, in the works of Thomas Aquinas, did Maritain find the answers he had been looking for. Maritain established himself first as a critic of modern thought in *Three Reformers: Luther, Descartes, and Rousseau* (1925) and as a political thinker in *The Things that Are Not Caesar's* (1927). In contrast to some other Catholic thinkers whose reflections betrayed a nostalgia for an *ancien régime* in which the Church would have a privileged position, Maritan's idea of a new Christendom, presented in his *Integral Humanism* (1936), recognized the Church's rights in its own

sphere, but promoted a pluralistic and democratic political society, "a convivium of Christians and non-Christians in the same body politic".

Maritain spent the war years teaching and writing in America. *The Person and the Common Good* (1947), *The Rights of Man and Natural Law* (1942), *Scholasticism and Politics* (1940), and *Christianity and Democracy* (1943) followed one another as he responded to the crisis of World War II.

Maritain's *The Degrees of Knowledge* (original 1932, trans. 1959) is his *summa* in the area of epistemology and metaphysics. This monumental work was the result of applying Thomistic principles of metaphysics and knowledge to the diversity of different sorts of knowledge in the world of contemporary science. Against the background of recent developments in relativity theory, quantum mechanics, and mathematics, Maritain studied the place of traditional philosophy of nature and of metaphysics, going beyond them into the degrees of suprarational knowledge in theological wisdom and mystical contemplation. The main contribution of this work was to clarify the relationship of the natural sciences, especially a mathematicized physics, to a metaphysical approach to reality in a way which involved distinguishing their complementary territories.

Maritain in his *Existence and the Existent* (1947) maintained, against the existentialism of Jean-Paul Sartre, that Aquinas's metaphysics affirmed the primacy of existence but at the same time affirmed the reality of essence as a principle of intelligibility in things and as an intrinsic limit on a thing's act of existing. However, since God's essence is *Esse Ipsum*, existence itself, there is no limiting principle and consequently God is a necessary and infinite being.

Early in his career Maritain shared his reflections on art and beauty in *Art and Scholasticism* (1920), originally a collection of papers on artistic knowledge and making. Maritain developed especially the idea that there is another kind of knowledge different from that of scientific knowledge, i.e. demonstrable knowledge of things, in their causes. This other knowledge, which he called knowledge by way of affective connaturality, arises from a closeness to things that some persons develop out of a love of what they work with or use. Such is the saintly person's knowledge of what should be done in a moral crisis, or the carpenter's knowledge of woodworking.

At 79 Maritain sought tranquillity and privacy, living with a religious community, the Little Brothers of Jesus, in Toulouse; this order had a Dominican inspiration and devoted itself to living in poverty and working with the poor. The mid-1960s saw the changes in the Church brought about by Vatican II. Maritain, always considered a liberal in social matters, found some of the progressive movements in the Church after the council less to his liking and published his reaction in *The Peasant of the Garonne*, a critique of some aspects of the 'new theology', in 1967. Maritain continued his religious thinking in *On the Church of Christ* (1970) and in the posthumously published *Approaches sans entraves* (1973). He died on 28 April 1973.

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DESMOND J. FITZGERALD

Marsilius of Inghen

Marsilius of Inghen, born around 1340 in the city of Nijmegen (see Braakhuis and Hoenen 1990), died in 1396 in Heidelberg. From 1362 onward, he was master at the Faculty of Arts at the University of Paris, where he was also rector (1367 and 1371), and student of theology. In 1386, he helped to found the University of Heidelberg, where he was Master of Arts, rector (1386–92 and 1396), Bachelor of Theology (1393), and Doctor of Theology (1395–6).

Marsilius's main works include logical writings (treatises on supposition, consequences, and obligations: see Marsilius 1983), commentaries on Aristotle (*Organon, Phys., De Gen. et Corr., Met.*), commentaries on the Bible, commentary on the Sentences (discussing theological as well as metaphysical and ontological questions), and writings on ecclesiastical politics. Most of his writings are still available in manuscript only, or in 15th- and 16th-century editions (some of which have been reprinted in the 1960s; see the bibliography in Berndt 1985).

Marsilius's universal interests are reflected in his extensive library, which contained not only many 13th- and 14th-century theological and philosophical writings, but also works on grammar, logic, mathematics, astronomy, law and medicine, and hermetical writings, as well as works of the classical authors.

In general, Marsilius should be considered an eclectical thinker, rather than an original one. He discussed and drew upon the views of the main thinkers of the 13th and 14th century, such as Bonaventure (1221–74), Thomas Aquinas, Giles of Rome (died 1316), and William Ockham. He was generally taken to belong to the Ockhamist tradition, but some of his theology and metaphysics rests on 13th-century, rather than on 14th-century, views (see Ritter 1921). Marsilius was a personal acquaintance of Nicole Oresme (1320–82), and of Geert Grote (1340–84). At the time of Marsilius's graduation at Heidelberg, professors of theology were Conrad of Soltau and Matthew of Cracow. Marsilius makes frequent use of unacknowledged literal quotations from other writers. Thus, in his treatise on obligations he rests on William Buser of Heusden (died after 1413); in his commentaries on Aristotle, on John Buridan (*c.* 1295/1300–*c.*1358) and on Albert of Saxony (*c.* 1316–90); in his commentary on the Sentences, on Thomas of Strasburg (died 1357), Adam Wodeham (*c.* 1298–1358), and Gregory of Rimini (*c.* 1300–58).

According to Marsilius, all natural knowledge is based either on perception or on self-evident principles. The existence of universals outside the mind or in singular objects is denied. The immediate object of knowledge is the proposition. Metaphysics is the highest species of natural knowledge, dealing with the most general principles. It can be proved by natural reason that God exists, that he has knowledge and volition, but not that he has free will, that he has infinite power, and that he can create *ex nihilo*. These latter truths are known to man by faith. God is perfectly one, all distinctions between his attributes are of a rational nature and made by man. The ideas in God are not formally distinct, but extrinsically and objectively so. By his *immensitas*, God knows the future contingents. It is within his power to create species which are better than any existing species, yet he always brings forth creation in the best possible way. God is an immeasurable spiritual quantity; therefore, no creature can be equal to God, neither in duration nor in any other respect; hence, no creature can be eternal. God is immediately active in each creature's activity, including man's free acts of will. Marsilius distinguishes between God's absolute power and his ordered power (*potentia absoluta* and *potentia ordinata*). Marsilius takes Aristotle and Averroes to hold that God is not only the final cause of the world, but also its efficient cause. Among Marsilius's metaphysical doctrines, his theory of God's knowledge (*scientia Dei*) appears to have been most influential.

Marsilius's views were widely received. His commentary on Aristotle's *Prior Analytics* was used at Prague in the 1380s; his logical works were used repeatedly at Vienna after 1392; his commentaries on the *Metaphysics* and on the *Physics* were read at Cracow throughout the first half of the 15th century, as were his other writings at the Universities of Heidelberg, Erfurt, Basel, and Freiburg. In 1499, the doctors and masters of the *Via Moderna* at the University of Heidelberg published a work containing epigrams on Marsilius by well-known humanists, such as Jacob Wympheling (1450–1528), as well as a reputedly Marsilian defence of nominalism (*Via Marsiliana*). Such epigrams can also be found in the Strasburg edition of Marsilius's commentary on the Sentences (1501). His treatise on obligations (printed in 1489 under the name of Peter of Ailly) was used by Thomas Bricot (died 1516), John Major (*c.* 1469–1550), and Domingo de Soto (*c.* 1494/5–

1560). Marsilius is mentioned repeatedly by Luther's teachers Jodocus Trutvetter (died 1519) and Bartholomew of Usingen (died 1532). His commentary on the *Prior Analytics* is cited by Agostino Nifo (*c.* 1469–*c.* 1546), and both Leonardo da Vinci (died 1519) and Galileo Galilei make reference to his commentary on *De Generatione et Corruptione*.

Marsilius's theological works, too, appear to have been widely received. The number of manuscripts of his commentary on the Sentences is considerably larger than was previously assumed; nine have been recorded so far. The commentary was known at Cracow in the first half of the 15th century, and was used by Thomas of Strampino (died 1460) in his *Principia* (1441–2). The University of Salamanca had a chair in theology (the *cátedra de nominales*) commenting upon Marsilius and Gabriel Biel (*c.* 1425–95). Spanish theologians such as Francisco de Vitoria (*c.* 1483/6–1546), Domingo de Soto, Luis de Molina (1535–1600), and Francisco Suárez (1548–1617), cited his commentary on the Sentences, especially in connection with issues concerning divine prescience and grace.

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MAARTEN HOENEN

Marty, Anton

Anton Marty (1847–1914) was a pupil of Franz Brentano and an acute continuer of his thought. His first important philosophical work is devoted to an old, and at the end of the 19th century to some extent discredited, problem: the problem of the origin of language. In Marty's days there predominated the view according to which language is either an organic reality whose beginning and development is to be explained in the same terms as any other vital process (a view defended by August Schleicher (1821–68)), or an involuntary emanation of the spirit that accompanies thought and makes it possible (Wilhelm von Humboldt (1767–1835), Hermann Steinthal (1823–99), Wilhelm Wundt (1832–1920)). Marty, by contrast, sees language not as an object of the natural sciences, nor as a moment within the psychological process of thought, but rather as a human institution – a view reiterated by Marty in a series of articles published between 1884 and 1892 (see his *Gesammelte Schriften*, Halle, 1916–18). Its origin must therefore be sought in that sort of deliberate practice which reflects man's need to communicate. Language is an instrument for communicating; but this does not mean that the 18th-century idea of language as an invention of man would be correct. Like William Dwight Whitney (1827–94), Marty also held that language was not invented and constructed consciously according to previously formulated rational criteria; rather, it developed gradually as the result of voluntary communicative acts without the support of any explicit plan.

The solution found by Marty to this problem led him to emphasize the instrumental nature of language. It is this which is the necessary starting-point in order to understand the project for a general grammar that Marty put forward from the 1890s at a time when the science of language was still dominated by the conviction that only historical linguistics could achieve scientifically valid results.

To speak of a general grammar does not mean, in Marty's view, that one loses sight of the fact that there exists an ineliminable difference between the logical and the grammatical structures of languages. But neither does it mean, as it did for Edmund Husserl, that one abandons concern with the level of empirical languages in order to outline a pure

morphology of meaning. In fact, Marty's general grammar is properly linguistic in nature and is founded on the conviction that the form of language depends entirely on the general conditions to which an instrument of communication has to submit.

These conditions can be understood by considering the dual nature of instruments: just as a knife has a handle for holding and a blade for cutting, so the form of language depends both on the nature of those who use it and on the reasons for which it is used. It follows – as Marty writes in his *Investigations on the Foundations of General Grammar* (Halle, 1908) – that the first task of a general grammar is to show the methods which enable people to manipulate linguistic signs in concrete ways, and to show how the difference between logic and grammar can be seen as a consequence of the adaptation of language to the characteristics and limits of human nature.

The second task of a general grammar is to indicate the functions that language must perform if it is to be an instrument of human communication. As Marty sees it, to communicate means to arouse in others determinate experiences; thus it is the task of descriptive psychology to outline a taxonomy of the possible forms of conscious experiences and, consequently (according to Marty), of the totality of semantic possibilities in any language.

Here Marty relies on the descriptive psychology of his teacher Brentano and on Brentano's classification of psychic phenomena, of which Marty was a convinced supporter throughout his life. Marty does not, however, confine himself to defending Brentano's theories against the attacks of Christoph Sigwart (1830–1904), Wundt, or Alexius Meinong; nor is he simply content to enlarge on some aspect of these theories. On the contrary, he argues strongly against Brentano's reism, subjecting the entire Brentanian doctrine of intentionality and its objects to a critical revision.

Like Husserl, Meinong, and Brentano before him, Marty denies the existence of mental objects as correlates of intentional acts. In his *Investigations* of 1908, he argues that when we think of a hippogriff, we do not picture a mental entity but, rather, a winged horse, and that if there were such a creature it would be no less real than all the other objects in the world. Assuming that hippogriffs do in fact exist, we would have on one side an ego that has experiences, and on the other a really existing object. Between these two poles there would obtain, Marty holds, a relation of similarity: the *adaequatio* between the intending act and the object of intention. Even when we acknowledge that winged horses are a mere fiction, we do not have to postulate the existence of any mental object, as if it were necessary to think of intentional acts in every case as relations that imply a correlative object. When I think of a hippogriff, my thinking does not have an objective correlate, not even a mental one. The reason for this is that my intentional experience does not posit a relation, but only implies its possibility; in fact the intentional act is posited as one of the foundations of a sort of relation of similarity that would become real and complete only if hippogriffs existed.

A denial of mental objects does not mean, however, that one must adopt, as the later Brentano does, a doctrine of reism. According to Marty, the later Brentano is mistaken in his refusal of the Aristotelian distinction between existence and reality. Marty believes that a real object is whatever can occur within a causal nexus, whereas an existing object is everything which can be asserted by a true existential judgement. Now, if an *ens rationis*, as Marty holds, can occur as the subject in a true existential judgement, it follows that existence pertains not only to real objects, but also to values and states of affairs.

The cause of this disagreement between Marty and his teacher is rooted in the concept of truth. For Marty, the truth of a proposition implies an *adaequatio rei ad intellectus*; there must therefore be an objective correlate of every true judgement which guarantees its truth. Consider the proposition '*A* exists'. The truth of this proposition is guaranteed by the fact that there is a certain state of affairs or content of judgement: 'the existence of *A*'. It is important to underline that, for Marty, the existence of such objects of reason does not depend upon their being thought: the

content of a true judgement exists independently of the act of judgement with which it is correlated. However, it is only by reflecting on a true and evident act of judgement that it is possible to grasp its objective correlate: contents of judgement are 'reflexive' in nature in the sense that the predicates they contain (existence, identity, possibility, etc.) can be grasped only by reflection on the corresponding psychic acts of the subject. Thus, even if *entia rationis* exist independently of a subject that thinks them, it is also true that there is a sense in which they imply psychological subjectivity; for Marty, as against Husserl, the presentation of someone judging that *A* exists is of necessity contained in the thought '*A* is true or exists'.

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PAOLO SPINICCI

Marxism-Leninism

Marxism-Leninism is the name given to the theory and practice of communism. As a practice, it is said to be the theoretical inspiration of the Communist Party, and thus belongs to sociology or political science. As a theory, Marxism-Leninism is divided – following Lenin – into philosophy, political economy, and scientific communism.

Although contemporary Soviet philosophers often use 'marxism' and 'Marxism-Leninism' interchangeably – claiming thereby a certain continuity in 'revolutionary' theory – both they and Western writers on the subject are clear that Marxian doctrines are only the *point de départ*. The true inspiration for Marxist-Leninist philosophy is to be found in Friedrich Engels's (1820–95) transmission of certain ideas of Karl Marx (1818–83) to Lenin (1870–1924), whose transformation thereof joined Stalin's (1879–1953) incredible over-simplifications, to produce what we now know as Marxist-Leninist philosophy.

Marxist-Leninist philosophy consists of dialectical materialism and historical materialism. The official definition of the former is "the science of the most general laws of nature, society and human thought". Historical materialism is "the application of the laws of dialectical materialism to history and society". 'Dialectic' here means 'conforming to the three laws of unity and conflict of contradictions', 'transition of quantitative changes into qualitative changes', and 'negation of negation'.

Dialectical materialism asserts that all is matter, all matter is in space and time, and in motion; and all motion follows the laws of the dialectic. It also affirms the basic epistemological thesis of Marxist-Leninist philosophy, namely that thought as a mirror-image of material reality participates in the dialectical character of this reality. In other words, there is a 'dialectic of nature' (Engels) or of matter, and there is a 'dialectic of thought', which is the domain of 'dialectical logic'.

Just as the dialectic of matter is reflected in the dialectic of thought, so – following historical materialism – social thought (or ideology) 'dialectically' reflects the dialectic inherent in social reality (or social matter), and this social reality is the economic infrastructure of social existence and of its history.

Thus, if one chooses to talk about ontology in the Marxist-Leninist context, one has to begin with a distinction between a 'fundamental ontology of material being' and a 'social ontology', while metaphysics in this same context will provide the over-arching 'dialectical' principles both of the being of these various components and of the dialectical relationships among them.

Lenin wanted his fundamental ontology to be a realism, devoting most of his *Materialism and Empirio-Criticism* (1908) to establishing this position against his political opponents, and his Marxist-Leninist disciples have worked mightily to keep to such a position.

Unfortunately, this 'realism' of Lenin is based not on Aristotle or Leibniz, or even Hegel, but on a sophomoric misunderstanding of Engels who thought that there was an identity between the relationships existing between thought and being, and those between spirit and nature (matter). In other words, the whole discussion was launched on the basis of a confusion between an ontological question (matter and spirit) and an epistemological one (thought and being).

Similarly, the search for a Marxist-Leninist 'social ontology' is burdened by a bias in favour of a naïve realism (the economic base ultimately determines the ideological and philosophical superstructure) which, however, has thus far failed to find the nexus at which economic energy is transferred to the realm of ideas.

These problems that Marxist-Leninist philosophy has at the level of ontology can be encapsulated by saying that any theory that wants to assert the material ('empirical') uniqueness of every existent alongside the ('metaphysical') materiality of the whole, as well as the uniqueness in society of each economic agent alongside the sociality of history as a whole, needs some sort of metaphysics.

It is the dialectic that is invoked in the final analysis to provide the metaphysical articulations that make it possible to seek if not to find a resolution to these quandaries. We cannot go into all the adventures of the dialectic here – from its Platonic beginnings to its Hegelian actuality. Something of all of these is to be found in the way the Soviets manipulate the dialectic.

The core of the Marxist-Leninist discussion on this point remains the issue of how dialectic, logic, and epistemology are related one to the other – are they identical? Or do they coincide? It was Engels who said that formal logic was good only for 'kitchen use', while there is a higher, 'dialectical' logic, and it was Lenin who asserted that logic, dialectic, and epistemology are the same, there being no need for three separate words. Along the way toward a solution of this problem, 'dialectic' has come to be interpreted by the Soviets as 'ontology' (an activity), though as 'dialectical logic' it provides the categories that make it possible to seek out a metaphysics for solving the two central problems we mentioned – that of an ontology of nature and that of a social ontology.

Thus, without being able to say that Marxist-Leninist philosophy has made tremendous strides in any direction, we can indicate that the attempts to address the 'basic question of all philosophy' have driven them in the direction of classical ontology and of traditional metaphysics, in the form of a search for the categories adequate to expressing the architectonic structures needed for appropriate characterization of the world.

For further details, see the *Sovietica* series, especially the titles listed below.

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THOMAS J. BLAKELEY

Mass, Matter, Material

Mass is that property of all material bodies in virtue of which they resist change of motion, and is typically measured by the amount of force necessary to cause a given body to accelerate. The concept of mass developed over a long period of time, beginning with the Neoplatonic doctrine of the impotence and inertness of matter. In the hands of Johannes Kepler (1571–1630), Sir Isaac Newton, and others, mass became the property which expresses the quantity of matter contained in any given body.

Mass has become the central scientific property of matter because it is found through empirical methods to be a well-behaved property. It plays a crucial role in many fundamental laws in physics – for example, the conservation laws for energy, momentum, and angular momentum, and

the two Newtonian equations, force = mass × acceleration, and (for any two bodies in the universe of mass m and m', G the universal gravitational constant, and d the distance between them) force of gravitational attraction = Gmm'/d^2. Mass's lawful interaction with gravity makes it possible (under normal conditions) to compare the masses of two objects by weighing them in the pans of a balance, though weight and mass are quite distinct concepts. Mass (in the sense of 'rest mass', or the mass of bodies measured by observers travelling with them) is the universal quantitative feature of a body which it retains everywhere and at all times, whereas weight varies from place to place and must be treated as a force equal to the product of a body's mass and the gravitational constant governing that local area. In addition, when two bodies combine to form a third, the resultant body's mass is the sum of the masses of its constituents, so that mass is additive and is thus quantitatively well-behaved in yet another way. The foundation of mass's quantitative usefulness is the fact that it admits of *ratio measure*. Thus, according to a definitive analysis by Ernst Mach (*Die Mechanik in ihrer Entwicklung, historisch-kritisch dargestellt* 1883; expounded by Jammer 1961 and Mackie 1973), the following empirically discovered facts hold for a body in an idealized environment in which only gravitational forces are acting between it and one other body. Accelerations in opposite directions are set up in both bodies so that, e.g., the ratio of A's acceleration to B's (K_{BA}) will be invariant, as will B's to C's (K_{CB}) and A's to C's (K_{CA}); K_{CA} equals the product, $K_{BA} \times K_{CB}$; and if B and C are joined to form a single body, the invariant ratio of A's acceleration to $B + C$'s ($K_{(B+C)A}$) will equal the sum, $K_{BA} + K_{CA}$.

All of these laws were shown to be only very close approximations when Albert Einstein's (1879–1955) special theory of relativity was confirmed in the 1930s. Mass was now shown to be identical with and convertible into energy. Thus experimental results, and not philosophical speculation, finally eliminated the neat common-sense picture of bits of matter as little substances which are acted on by external forces. Instead, matter and forces are inextricably intertwined, and the only 'substance' in view on most current models of matter is the spacetime manifold. Physicists currently recognize three forces which can characterize that manifold in regions where a material object's spacetime path (or 'world line') is found: gravitational, electroweak, and the strong nuclear force.

'Matter' is the most general noun used to refer to that which composes physical bodies. In Aristotle and some medieval philosophers, 'prime matter' was thought of as an inchoate and indeterminate substratum waiting to be endowed with various sorts of forms.

But the concept of matter which survived into the modern era began with the ancient atomists' thought that matter was divided up into indivisible units of 'what is' or 'the full'. 'What is' must be sharply distinguished from 'what is not', or 'the empty' – that is, the void in which the units are moving. The atomists explained changes in observable things by reference to changes in shape, position, and arrangement of the constituent atoms. Later Plato, in the *Timaeus*, adumbrated the view that material objects are identical with the geometric space they are typically taken to occupy.

But Plato's geometric view raised a central question: isn't there more to matter than mere spatial extension? In terms of the original atomist system the question is: what fills up 'the full' so as to distinguish it from 'the empty'?. The atomists themselves had used the quality of solidity or firmness (*stereos*; see Bailey 1928) as the atoms' distinctively 'material' quality. And later the Stoic response was that matter is distinct from mere extension due to the presence in it of 'pneuma' (a mixture of air and fire: Sambursky 1956). Pneuma pervades all of space and provides the basis for matter's material quality of cohesion or tension – a property which empty space cannot have. In the Stoic system, all the world's matter forms a unified, seamless continuum in a constant state of tension, and causal relations are likened to the propagation of waves in a medium: thus they claimed that if there were empty spaces between the parts of matter,

sound waves and light signals could never reach would-be perceivers.

When atomism was revived in the 1600s, a canonical list of 'primary qualities' was devised for material things. That list reveals a similar cleavage between purely spatial (or, in the case of motion, spatio-temporal) features and strictly material qualities. Spatial/spatio-temporal primary qualities include *extension, size, shape, volume* (or 'bulk'), *position, arrangement*, and *state of motion*; material primary qualities include *inertness, impenetrability, solidity*, and *mass*.

In the modern era these primary qualities were accorded a privileged ontological status because they are essential to mechanistic explanations – and of course the moderns saw mechanism as vastly superior to the old scholastic style of explanation involving mysterious virtues and faculties. They are also thought of as favoured from an epistemic standpoint, since, unlike the 'secondary qualities' of colour, smell, taste, feeling, and sound, they are not radically dependent on human senses. Very early on the latter had been rejected by Democritus, mainly on epistemic grounds: "By convention sweet, by convention bitter, by convention hot, by convention cold, by convention colour: but in reality atoms and void". Of course Democritus and his associates were the first mechanists, and so they were likely to have been also motivated by such ontological considerations as the fact that the secondary qualities are completely idle in mechanistic explanations.

Leibniz was perhaps the first to launch a systematic critique (outlined in Hartz 1984) of the atomism of Robert Boyle (1627–91), Newton, John Locke, and others. In particular, he claims that the atomist's material primary qualities of impenetrability, solidity, inertness, and mass all point to matter's being completely passive. Hence the atomist has no naturalistic explanation of the obvious activity and motion of material things; instead, he has to keep dragging God in *ex machina* to set the inert bits of matter in motion and keep the universe of inert objects from winding down to a halt. In place of this metaphysic, Leibniz offered a dynamic view of matter, even claiming that matter is constituted by forces of various sorts. Thus his view is closer than any atomist's to the contemporary view of matter as the resultant manifestation of various kinds of forces.

Another of Leibniz's criticisms was the claim that the atomist's material primary qualities are, unlike Leibnizian forces, purely *relational*, and hence cannot provide an inherent or monadic quality for body. The scientific realists J. J. C. Smart (1963), D. M. Armstrong (1961), and J. L. Mackie (1973) have reintroduced this concern into contemporary discussion. Smart looked at the primary qualities offered him by current physics – e.g., length, shape, mass, charge, spin – and, seeing that all of them seemed to involve essential reference to something other than the body which had them, asked, "Can a thing have relational properties only?" The answer seems to be negative on conceptual grounds alone: a thing must have some monadic qualities in order to *be* a thing at all and to stand in various relations. Armstrong responds to Smart's query by claiming that impenetrability and solidity are clearly relational, and that mass and charge seem to "dissolve into relations, or dispositions to have relations, that one particle has to another particle". He concludes that either we must use as matter's inherent nature the grotesquely inappropriate secondary qualities, or "postulate further qualities 'I know not what' which, as it were, provide the stuffing for physical objects". Since we can't adopt the former option, we are left in the intolerable position of holding that "we know absolutely nothing of the intrinsic nature of physical objects, except their spatial properties".

Mackie offers a solution to this problem, claiming that a scientific realist should postulate for all dispositions of material things a categorical basis which is contingently related to the disposition, as molecular structure is to fragility. In the case of mass, even though it is "introduced in a dispositional style", *what* is introduced is "some intrinsic quantitative feature which reacts contingently but lawfully with imposed forces". How much do we know about this intrinsic side of mass? Not much: "it is reasonable to postulate that there is a relatively permanent quantitative some-

thing-or-other intrinsic to objects and additive in all their normal combinations".

Of course this 'solution' raises the old Lockean problem, recognized by Armstrong, of an unknown substratum: as Howard Robinson (1982) has recently argued, the scientific realist's last-ditch response seems to be that matter's inherent nature is a 'nameless categorical residue' which is designed to stop, by definition, the regress from one set of dispositions to another. It is significant that experimental results, and not the speculations of philosophers, have forced the issue to take this form. Physicists keep finding more new primary qualities, but all of them seem dispositional. Thus the philosopher who wishes to avoid non-realist positions like phenomenalism or idealism is forced either to postulate an end to the reduction of dispositions to further dispositions, or else to accept the conceptual problems associated with the view that material bodies have only dispositional properties.

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GLENN A. HARTZ

Mass Terms

The first question that should be answered here is what is a mass term? Most works, unfortunately, do not answer this basic question, but instead give examples from which the reader is to formulate his own concept of what a mass term is. A traditional opposition is between mass terms and count terms – although the notion of what a count term is most often also goes unanswered. (And in any case, most theorists believe there to be many terms which are neither count nor mass.)

Most commonly, mass and count terms are presented by example: *water* is a mass term, *person* is a count term; *computer software* is a mass term, *computer program* is a count term; *furniture* is a mass term, *house* is a count term. Sometimes these examples are accompanied by explanations like the following:

1. Count terms (but not mass terms) can occur with the quantifiers *each, every, many, few*, and *some* (as a stressed quantifier). Count terms (but not mass terms) can occur with the indefinite article. Count terms (but not mass terms) can occur with counting phrases like *three* or *a dozen* (*of*). Count terms (but not mass terms) exhibit a singular/plural dichotomy manifested both in the term itself and in verb agreement. On the other hand, mass terms (but not count terms) can occur with the quantifiers *much* and *little*. The indefinite article appropriate to mass terms (but not appropriate to singular count terms) is the unstressed *some* (which will be written as *sm* in what follows). Mass terms (but not count terms) can be used with measurement phrases like *amount of* and *litres of*. Mass terms do not have a plural form.
2. Count terms refer to discrete, delineated entities; mass terms refer to undifferentiated stuff. Count terms 'contain within themselves a principle of individuation'; mass terms refer without explicitly individuating their referent into objects. Mass terms (but not count terms) have 'cumulative reference': given any group of parts of which the mass term is true, the mass term is also true of their sum. Mass terms (but not

count terms) also have 'homogeneous (or divided, distributive, divisive) reference': given anything of which a mass term is true, the term is also true of its parts.

3. Count terms (but not mass terms) are used by speakers when they wish to indicate that they know how to individuate a certain portion of the world from another portion; they are used when the speaker understands how one instance is marked off from another instance of the count term. Mass terms are used when the speaker wishes to identify one aspect of the world, but not with any intent to individuate. The main test here is that, given a space appropriate to an expression *E*, if it makes sense to ask how many *E*s are in that space then *E* is a count term.

Does Mass/Count Apply to Anything Besides Noun Phrases? From the three types of characterization just stated, it is obvious that the mass/count distinction is primarily thought to apply to noun phrases. But, some authors have also suggested that it might be extended to other types of expressions. Adjective phrases (e.g., *spherical*) might be called count because they can only be applied to count nouns. Verbs which can only take mass (or count) subjects might thereby also be called mass (or count) – assuming there are any such verbs. This sense in which an element from a syntactic category other than NP might be called mass or count is probably better treated as an agreement feature. It is certainly not the case that these adjective phrases or verbs have any properties which are in any sense analogous to the count/mass distinction amongst NPs. It has, however, been noted that there might be the appropriate kind of analogy within verb phrases. The idea is that the denotation of a VP is an event, and that events can be parts of larger events and can contain subevents. Sometimes these subevents can be described by the same verb phrase – especially when the event in question is a process such as *to eat* or *to run*. Other VPs (such as *to win* or *to prove*) describe achievements and involve the attainment of some final state. Such events do not have subevents which can be described correctly by the VP.

Once this basic analogy is discovered, one can investigate the effect of adding a mass or a count direct object to a mass or count verb – trying to decide whether the resulting VP always inherits the mass or count feature from the verb or from the object. Similarly, one can consider adverbial phrases to be mass or count by analogy. Adverbs like *for hours* are temporally 'unbounded', ones like *along the road* are spatially 'unbounded'. Adverbs like *in an hour* are temporally 'bounded', ones like *to the city* are spatially 'bounded'. One might think of the 'unbounded' adverb phrases as mass-like, and the 'bounded' ones as count-like. Again, one might investigate the effect of adding these mass and count adverbs to a verb which is basically mass or count; and indeed one might investigate the overall effect of mass/count verbs, mass/count objects, and mass/count adverbs. Discussions of these phenomena can be found in many places, but see especially Mourelatos (1978), Hoepelman (1976), and ter Meulen (1980). For the remainder of this article we will stick to mass/count as a property of NPs.

Do the Criteria Really Distinguish Anything? The three types of criteria listed above which have been used to distinguish mass from count terms fall into three different categories of tests: syntactic, semantic, and pragmatic, depending upon whether one views the mass/count distinction as giving conditions on well-formedness, on reference, or on how people differentially use various terms. To evaluate the usefulness of any of these different categories in any detail is beyond the scope of a short survey article, but the following (negative) points might be noted. As regards, first, the pragmatic distinction: it has been convincingly argued by R. X. Ware (see Pelletier 1979, pp. 15–29) that in most instances speakers simply have no intentions that are relevant. The very same 'communicative intentions' might lead a speaker to say *a lot of difference* and *many differences*, or to say *much more data* and *many more data*. Speakers might have 'mass-like intentions' when they ask for more beans or more eggs – should that make *beans* and *eggs* mass? Should the fact that speakers

might have 'individuating intentions' when they ask for more toast or more eggs make *toast* and *eggs* count? The pragmatic criterion seems doomed. As regards the semantic distinction: it seems that there is nothing in the referent of the terms that should make *fruit* mass and *vegetable* count, *baklava* mass and *brownie* count, *rice* mass and *bean* count. Furthermore, different languages sometimes use (alleged) count terms and sometimes (alleged) mass terms to refer to the same thing. (Consider the English *dandruff* which is (allegedly) mass, and the French *les pellicules* which is (allegedly) count. Consider also *dish(es)* vs. *la vaiselle*.)

Furthermore, as F. J. Pelletier has pointed out, for any allegedly count term that denotes a physical object there is a related term which is arguably mass (see Pelletier 1979, pp. 1–14; this work also contains a discussion of the applicability of the distinction to terms denoting non-physical objects). Consider the 'Universal Grinder', a device that takes in an object corresponding to the count term and spews out the finely ground matter of which it is made. A hat, for instance, is fed into it and afterwards there is hat all over the floor. This is so despite the fact that there is another word we might have used (for example, *felt* or *straw*). So for any word one would wish to call a count term, there is a related mass term designating, roughly, the stuff of which it is made. Conversely, universal objectifiers come to mind. In any case, whenever standard portions or standard uses for the stuff corresponding to a mass term have been established, one will find a count term for it: three beers, an ice cream, a finely silted mud. There is also the count term (for any mass term *M*) which means, roughly, *a kind of M*.

Given the foregoing, it is not surprising that even the syntactic criteria have been attacked. It just is false, for example, that *mud* cannot occur with numeral modifier, or the indefinite article. It is false, for example, that *soldier* does not occur with the unstressed *sm*. After the grenade has exploded in the enemy bunker, Rambo might enter and notice that the walls contain three different muds mixed with sm soldier.

The failure of any of the different types of criteria to divide even nouns into separate classes suggests that nouns or noun phrases considered in the abstract or in isolation are not what *mass* and *count* should apply to. Instead, perhaps, it should be the noun phrase *as it is used in a particular sentence* which should be classified as either mass or count. Thus it will not be a word, not even a word in a sentence, which is count or mass; rather it is the entire NP as it appears in the specific sentence under consideration which is to be judged count or mass. This would seem to suggest that the distinction is not a matter of syntax, for the same noun might in one sentence be in a count NP and in another be in a mass NP. A syntactic distinction, after all, is supposed to enforce a well-formedness constraint; but we have just seen that any noun can be used in either a mass or a count way . . . no constructions would be ruled out by such features and so they cannot be syntactically motivated.

Instead, they should be viewed as semantic 'directives' telling us how to evaluate the NP as it occurs in some sentence. In sentences like *I had lamb for dinner* and *Apple was in the salad* the 'directive' might be to interpret *lamb* and *apple* in a way that is true of certain kinds of stuff regardless of how much of the stuff there is (and regardless of how many naturally occurring objects the stuff was derived from). In sentences like *I had a lamb for dinner* and *An apple was in the salad* the 'directive' would interpret them as true only if there was an entire naturally occurring object (a lamb or an apple) which satisfied the sentence. This suggests that there should be sentences in which there is an ambiguity as to what the 'directive' is; and indeed this seems to be precisely what happens when the (alleged) mass term has the same form as the (alleged) plural count term. Sentences like *John likes his data, Mary had potatoes for supper*, and the like are ambiguous in just this way. Furthermore, it explains the ambiguity of such sentences as *This tavern has sixteen beers* (kinds vs. individual portions) and *This bunker contained four soldiers* (individuals vs. kinds of soldiers – e.g., from different countries).

What Ontology do Mass Terms Presuppose? The ontology presupposed by this outlook on mass terms is this. First, there are

ordinary individuals such as Ralph, this ottoman, and the beer in the bottle before me. Such items are in the extension of such predicates as *is a person, is furniture, is a beer*, and *is beer*. Second, there are kinds: *Homo sapiens*, Furniture, Beer. The kinds ought to be thought of as forming an upper semi-lattice of kinds. Thus, Beer might be atop the semi-lattice with Pilsner, Lager... etc., falling under it. This is a 'formal' semi-lattice in the sense that the union of any two kinds in the lattice is also a member of the lattice. These kinds are denoted by an entire NP (e.g., by *beer, pilsner, lager*) and are all in the extension of the predicate *is X* where *X* is the name for the top of the lattice. Thus, we have *pilsner is beer, lager is beer*, and even *beer is beer*. Predications of this sort are ambiguous (or perhaps one meaning is derived from the other by virtue of meaning postulates) between interpreting the subject NP as denoting a member of the semi-lattice and being universally quantified with the subject term treated as a predicate.

Some of these kinds (roughly: those which are conventionally recognized as an important kind of *X*) are *conventional kinds*, and they are in the extension of the predicate *is an X*. Thus, *pilsner is a beer* and *lager is a beer* are true. But not every member of the formal semi-lattice is a conventional kind – for example lager mixed with pilsner is not *a* beer (although it is beer), beer is not *a* beer (since it is not a conventionally recognized kind of beer).

It is implausible to suppose that these kinds can be identified with any physical object such as the mereological sum or fusion:

1. (Due to Montague, see Pelletier 1979, pp. 173–78.) Consider two possible but as-yet unrealized substances, Kaplanite and Suppessium. They are defined in such a way as to be distinct (e.g., by having different atomic numbers) but their mereological sums are identical, namely the null individual.
2. The mereological sum of water is all the water in the world, but *all the water in the world weighs billions of tonnes* is true while *water weighs billions of tonnes* is nonsensical.
3. (Due to T. Parsons, see Pelletier 1979, pp. 137–66.) All the wood in the world might be made into furniture and all the furniture made of wood, so the mereological fusions of wood and furniture would be the same. Yet even so, wood and furniture are distinct (because, e.g., this chair leg would be wood but not furniture).

It seems that the kinds must be intensional entities.

One might wish to distinguish between ordinary objects and the particular quantity of matter which comprises them. One might therefore distinguish between my ring and the specific quantity of silver of which it is made. In this case, these quantities will also be in the extension of such predicates as *is silver*, in addition to the objects. Of course, for this example *is a silver* is not true of either the ring or of the quantity of matter. But this is not always the case: both *is an apple* and *is apple* are true of the object before me, but arguably only *is apple* is true of the quantity of matter of which the object is made. After Rambo enters the bunker, *is soldier* but not *is a soldier* is true of what he finds on the walls.

In addition to the preceding uses, there is also the use of (say) *a beer* to refer to an individual serving of beer. It is not clear whether this use refers to the contents – that is, the individual quantity – in the serving or to the size (or amount) of the serving. As we have seen, *is beer* is true of the contents of the serving, but if this use of *a beer* referred to the amount rather than the contents then a waiter could bring that amount of water in response to an order of a beer. On the other hand, if *a beer* refers to the actual quantity, then *a beer is beer* (when *a beer* is used in this manner) ought to be necessarily true. But it is not clear that this is so.

Finally, there is also the use of such phrases to refer to conventionally recognized *types* of servings. This is the sense in which, although the five of us at the table each have a beer, there are only three (distinct) beers on the table: a pint, a 12 oz. bottle, and a 7 oz. glass. (Those are standard types of servings in certain areas of North America.) Again, for reasons similar to those given above with

regard to kinds, it seems that these conventionally recognized types of servings cannot be identified with any physical manifestations.

What is the Origin of the Mass/Count Distinction? Considerations such as the above might lead one to speculate as follows. Our language is suited to picking out certain features of the world – redness, watery-ness, human-male-ness, and the like. It does this by having predicates which are true of these aspects of reality: *is red, is water, is man*. Such predicates are true of any appropriate aspect of the world, including the parts of such an aspect (thus such predicates pass the divisive and cumulative tests). Often, however, what we find interesting about reality is not merely the fact that reality manifests this feature but also that this particular region of reality has some further use. Such uses are determined by physics, or biology, or culture, or merely personal whim; they can often seem completely haphazard. But if the utility is great, we associate an 'object' with particular manifestations of that feature. If the utility in doing this is very great, the other 'feature placing' use will slip into the background – but it will still be there and can be called upon when the circumstances are right. Thus, *potato* describes a certain aspect of reality, and the predicate *is potato* is true of that area of the world (and of its parts). If, however, agriculture or food selling makes it convenient to look at the various areas of reality of which this predicate is true as being discrete from one another and each area as having its own uniqueness, we might decide to talk about *one potato, two potatoes, a potato, each potato* . . . inventing, as it were, a 'count term'. But the original 'feature placing, mass-like term' still remains and is still used when the circumstances are appropriate (as in ordering some food). For whatever reason, such a count use of *potato* is common; but the same thing did not happen to *garlic*. Sometimes the utility is so great that the 'feature placing, mass-like use' becomes so rare as to almost never come to mind. No doubt due to the importance of our interpersonal relationships, *is man* hardly ever is used while *is a man* is very common. But as the universal grinder, the Rambo story, and such uses as *what a hunk of man!* illustrate, the 'mass like' use is still there waiting for appropriate circumstances. This also explains why universal objectifiers can be imagined: we can conceive of special occasions (or maybe just whims) in which it would be useful to treat these features of reality as objects.

It is difficult to account for the bewildering set of examples wherein one is tempted to call a use of a term mass vs. count. There seems to be nothing in the reality referred to which would explain why we say that we sell fruit (mass?) but that we sell vegetables (count?). There also seems to be nothing in the (conscious) communicative intentions that could explain it. And in any case, it seems that every term could be used in either way, given the right circumstances. The above story, where this is described in terms of 'feature placing' plus communicative utility modulated by historical accident, is offered as one possible explanation. Doubtless there are others.

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FRANCIS J. PELLETIER

Materialism, Physicalism

Materialism at its simplest holds that everything is composed of matter, and that the properties of matter determine all properties of things, persons included. *Physicalist* materialism, or *physicalism*, merely replaces matter in this scheme with whatever entities or processes are taken as basic by math-

ematical physics, such as intangible dynamic fields, variably curved space-time, or quantum indeterminacy and the related spontaneous appearance of mass-energy in the vacuum. Contemporary materialists tend to be physicalists, and to reject classical conceptions of matter as indivisible, deterministic atoms colliding in a passive void.

Most physicalists also reject abstract entities like numbers and sets. But some believe (with W. V. O. Quine) that physics is committed to *abstracta* by way of the mathematics required for formulating its theories; positing numbers or sets is no different in principle from positing electrons. Everything concrete is composed of basic physical entities, while everything abstract can be constructed out of numbers or sets. Thus everything whatsoever remains composed of the entities posited by mathematical physics.

Physicalism is supposed to be an empirical hypothesis, subject to revision and even rejection in the light of ongoing investigation. In this respect, physicalism is to resemble the very general theories characteristic of physics, and is to be subject to the same historical contingencies. Neither physicalism nor the differing conceptions of rationality and method held by its adherents should be stereotyped as designed to end all uncertainty by invoking some *a priori* rationality superior to and withdrawn from historical change.

Nor should physicalism be stereotyped as entailing scientific imperialism, or *scientism*. Scientism accords unconditional primacy to scientific language, treating any language not reducible to the scientific as defective. Such was the physicalism of the Vienna Circle's Unity of Science movement. By contrast, there are now versions of physicalism that are not only *non-reductive* but recognize how language and methods outside science often take priority (Post 1987). Physicalism is non-reductive when it does not require properties outside the sciences to be equivalent to some compound of properties from the sciences. Persons, for example, can have many irreducible properties, even if the person's properties are all possessed or realized by the collection of physical entities we call the body. Such a physicalism combines a monism of entities – the mathematical-physical – with a pluralism of properties.

This pluralism of properties enables the physicalist to agree that there are as many ways things are as they have kinds of properties – they are not *nothing but* physical things. The physical properties take priority only when our aim is to give a certain sort of explanation and unification of the phenomena, one according to which how they are is determined by the properties of the basic physical entities. This is compatible with the coexistence of many other kinds of unity, equally privileged. Also it contrasts with traditional varieties of metaphysics, traditional materialism included, according to which there is just one most basic or essential nature of things, plus some vocabulary to express it that has unconditional primacy over all others.

Why has physicalism so often been reductive? Largely because no one thought the non-physical properties of things could be determined by physical properties except by being reducible to them. If a person's mental properties are reducible in the sense of being equivalent to certain properties of the basic physical entities, then the mental properties clearly are determined by the physical. But if they are not reducible, how could they be determined? Unfortunately, some apparently genuine properties resist reduction – especially those that involve intentionality, consciousness, or value.

This resistance to reduction leaves just two choices for physicalists who think that all genuine properties must be physically reducible. One is to keep looking for a reduction. The other is to concede that no reduction is possible, but conclude that the irreducible properties are for that reason not genuine. They have no place in an objective account of the world, and should be eliminated in favour of properties that do – the reducible ones. This is *eliminative* physicalism, or *eliminativism*, according to which irreducible talk of consciousness and of intentional matters like beliefs and their contents is but the residue of an outdated folk psychology (Churchland 1979). All such folk-psychological talk is to be replaced by predicates from a completed neuroscience, which will provide an objective

and empirically adequate explanation of human behaviour.

Some physicalists reject the eliminativist's underlying reductivism. The genuine properties of things are physically determined even when they are *not* reducible. G. Hellman and F. Thompson (1975) gave the first rigorous account of this *non-reductive determination*. Soon after, others independently defined a variety of similar relations called *supervenience*, some of which proved equivalent to determination in Hellman and Thompson's sense. Determination and supervenience can be defined in terms of physically possible worlds – worlds whose entities satisfy the laws of physics. The non-physical properties N are determined by the physical properties P just in case given any two physically possible worlds, if the entities in them have the same P-properties, they also have the same N-properties; worlds that are physical duplicates are non-physical duplicates.

For example, consider two worlds that are the same not only as regards a certain belief's P-properties (P-relations included) but as regards the P-properties of whatever distant entity x the belief is about. There need be no physical or causal relation between the belief and x. None the less, if physical determination holds, these two worlds will be the same as regards the belief's N-properties, such as its being about a certain affair, and its being true. What determines an object's N-properties (such as the property of being about x) need not be restricted to the object's own P-properties, but can include the P-properties of things not only separated from it in space and time but in no causal relation with it.

Non-reductive determination is thus compatible with a high degree of holism and historicity, as many think it must be if physicalists are to account for beliefs, their contents, and other intentional matters. One such account starts with Millikan (1984) and explains how the biological matters her theory says determine meaning and intentionality are themselves determined, in a history, by the physical properties of things and their environment (Post 1991). Physicalists have also applied non-reductive determination to try to accommodate consciousness, metaphorical truth, secondary qualities, objectively true moral judgements, and even theism.

According to some physicalists, determination and supervenience must be reductive after all. That the N-properties are determined by or supervene on the P-properties entails that for each realized N there is a P-property equivalent to N. Others reply that

1. the argument for this alleged entailment presupposes the questionable principle that the negation of a physical property is itself a physical property, and
2. there are counterexamples to the alleged entailment.

One response to this reply concedes that the entailment does not hold after all, but argues that any plausible relation of dependency of N on P *ought* to entail that for each realized N there is a P equivalent to N; otherwise we could have no *evidence* for the dependency. Others argue to the contrary, that we often do have evidence for dependency relations like determination even when they entail no such reductive equivalence. Much remains to be done to clarify this situation.

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JOHN F. POST

Mathematical Objects

Mathematics has often been taken to be the paradigm of objective, necessary and *a priori* truth, the science which makes all others possible. But if the body of mathematics

consists of truths, what are these truths about? What are the *objects* of mathematical theories?

In the first place, it seems that mathematical objects cannot be physical, both because mathematical truths are supposed to be necessary and *a priori*, and because mathematics ascribes no basic spatio-temporal properties to its objects. Yet surely we ought to be able to account for the applicability of mathematics to the physical world. With this in mind, the two most obvious answers as to what mathematics is about are represented historically by the accounts of Plato and Aristotle. The Platonic answer is to say that mathematics deals with timeless and unchanging abstract objects, and, according to Plato at least, is applicable to the physical world because this latter contains (imperfect) copies of the ideal mathematical objects. The central difficulty with this view is an epistemological one, that of explaining how it is that we can know *any* truths about such ideal objects. In particular, if mathematics is about a realm of objects outside of space and time, thus about objects which cannot enter into causal relations with us, then how do we have any access to those objects in order to learn truths about them? Certainly, if we insist on some version of a causal theory of knowledge, according to which causal contact is necessary for knowledge, then any hope of learning about acausal mathematical objects is ruled out. If the acausal view of mathematical objects is to be maintained, therefore, it looks as if the causal theory of knowledge has to be given up. (Nevertheless, it would be a mistake to say too quickly that abstract objects have no causal efficacy whatever, as Gottlob Frege pointed out.) It is often held that this epistemological difficulty requires the appeal to sources of knowledge other than that giving knowledge of those things with which we are in causal contact. Plato thought that we know truths about, say, triangles because we have knowledge through a dim sort of memory of that blissful state in which we *did* have 'contact' with the abstract objects of mathematics. But it seems that this is just to sidestep the question. Others have thought that we know mathematical truths through some kind of direct intuition of the objects. To cite perhaps the most famous modern example, this has been the standard way to view the various statements of Kurt Gödel (see Gödel 1964).

It should be noted that the view that we do have special faculties yielding knowledge of mathematical objects is aided by reductionism, i.e., by the view that mathematics is really only about a restricted variety of objects, for example, just about sets or just about categories. For, if we are to postulate special faculties, then it would certainly help the plausibility, and reduce the sense of *ad hoc*ness, of such claims if there were not too many different kinds of objects with which we are supposed to have special contact. Thus reductionism is certainly helpful to this view, whether the view itself actually encourages reductionism, or whether, conversely, the success of reductionism encourages it.

The Aristotelian view starts from the reverse of the Platonic theory as to how mathematics can be about the world. According to this, the physical world does not mirror the mathematical world. It is, rather, the other way around: the objects of mathematics are *abstractions* from physically realized structures and quantities. Thus, to take one example, natural numbers are considered as multiplicities of 'units', as Euclid tells us, each unit being abstracted from one object belonging to the collection that the number is to number. This view solves some problems. For instance, it allows that mathematical objects are abstract (timeless and spaceless) enough to be unchanging objects of an *a priori* discipline, and it ought to allow a satisfying connection between mathematical theories and the physical world. But although adequate in some respects, the account presupposes (among other things) a plausible way of construing abstraction, and it is not at all clear that, in the end, appeal to abstraction is any more helpful, or any clearer, than the appeal to a special faculty of intuition. (For a famous attack on abstraction, especially as the basis of the Euclidean conception of natural number, see Frege's *Grundlagen der Arithmetik* of 1884, Sections 29–44.)

Without the appeal to abstraction, the Aristotelian view collapses into what has recently become known as physicalism, the

view that all there is, ultimately, is the physical world and its objects. This gives rise to a variety of theories about mathematics. At one extreme, there is the view that mathematical theories really do have an empirical content, no matter how diluted, because mathematical statements are, in the last analysis, just about physical objects. According to this view, sets and numbers are taken, bizarrely, to be in the world. What is strange about this as a view of the aim of mathematics, as opposed to just a view about the heuristic suggestivity of physical structure, is that, whatever the starting-point, mathematics is supposed to conclude with *certain* truths and not just with fallible, empirical generalizations. This is quite different from physics. After all, we may hold things about recondite physical particles, but would not claim certainty for these propositions, whatever likelihood we may ascribe to them. (Note the related view, most famously represented by Imre Lakatos (1922–74) (see Lakatos 1976), that the methods of mathematics are similar to empirical methods. Views like Lakatos's seem to be neutral between the position that mathematical objects are physically present in the world, and the view that, on the contrary, they inhabit some abstract realm, but that we discover things about this realm only with difficulty.) At the other physicalist extreme, there is the view that mathematical statements are not really about anything – they are formal, but empty, statements which are just useful for deriving truths about the physical world, a kind of generalized logic in fact. (This kind of physicalism is related to the instrumentalist way of reading David Hilbert. For a sophisticated version, see Hartry Field 1980.) Nevertheless, even to begin to defend this view, one has to claim, somewhat miraculously, that the physical world contains things which are very like the abstract objects needed if mathematics were to be true. For example, although this form of physicalism contends that there are no such things as abstract points, it none the less holds that there are such things as 'space-time points', and one suspects that these are just as abstract. Moreover, we seem to learn what is really in the world by inspecting the would-be-ontologies of the mathematical theories which are used to describe the world. This heuristic role is a strange one for supposedly empty theories to play.

Another approach to mathematical objects is to allow that their existence follows quite straightforwardly either from the adoption of certain mathematical truths, or, more weakly, from the acceptance of a body of sentences as true according to some coherent canons of acceptability. For, it is asked, how could these sentences possibly be true, or even candidates for truth, if the singular terms used in them do not refer to objects? Given this view of mathematical objects, mathematical Platonism (the belief that mathematics is about some independent realm of objects) collapses to the acceptance of certain statements as objectively correct. (See the various papers on realism and Platonism in Michael Dummett 1978.) But what are the statements accepted, and why?

Two of the three famous '-isms' in 20th-century philosophy of mathematics (logicism, formalism, and intuitionism) might be viewed as answers to this question. The logicist answer, going back to Frege and Bertrand Russell, is that mathematics reduces to pure logic. Thus, it is claimed that, not only do we use logical laws in the derivation of theorems from axioms, but that it is possible to give a restricted set of axioms each member of which is itself a logical truth, the set being nevertheless sufficient for the derivation of all known mathematics. Mathematical objects are then 'logical objects', to borrow a term from Frege, these being (presumably) the things which the basic logical laws force us to accept. But the logicist answer runs into problems for two reasons. In the first place, in the wake of the set-theoretic antinomies, it seems that, to give principles which are sufficient for the derivation of classical mathematics, we have to admit axioms which are clearly not logical truths, axioms like those of choice or infinity (which asserts the existence of an infinite collection), or even *ad hoc* principles like Russell's axiom of reducibility. Second, in addition to this failure, there is no general characterization given of what constitutes, or how to recognize, a logical law. This is unfortunate, for the theory purports to tell us why the statements

of mathematics are accepted – because they are derivable from logical laws – but specifies no sure way of telling when a proposed law of logic really is such. This difficulty already shows itself with the discovery of the set-theoretic antinomies, for the principle of comprehension and Frege's Rule V were taken to be obvious logical laws, and yet turned out to spawn contradiction. Russell's subsequent building of the ramified theory of types, despite the enormous importance of this, looks suspiciously like an attempt to get the mathematical derivations right first, and then to worry about whether the principles involved are logical or not, rather than being an attempt to tap a clear intuition as to what is logical. Put in this way, some of the difficulties faced by this theory are similar to those which face the Platonic position mentioned above, that is, difficulties of an epistemological nature.

Hilbert's formalism might be seen as another answer to the question of what statements to accept. However, in this case acceptance does not follow because we recognize mathematics as true; rather, truth is collapsed to acceptance. One key element in Hilbert's approach to acceptability was the notion of consistency, though this was not the only important element (see Hallett 1989). There are two important things about this that should be noted here. First, Hilbert adopts explicitly the doctrine that 'consistency implies existence'; he is quite clear about this in his correspondence with Frege. Second, the Hilbert programme, which led to the appellation 'formalism', is an attempt to explain what consistency amounts to in a largely syntactic way, i.e., without regard to the particular content of the individual terms of sentences. Thus, putting the two together, we have a syntactic approach to the issue of what mathematics is about. Hilbert conjectured that axiom systems will be sufficient for the development of mathematical theories, and that a weak system of arithmetic will be strong enough to prove the consistency of the basic, powerful mathematical theories. Both claims must be modified in the light of Gödel's incompleteness results. If one believes that number theory in particular is about a range of objects in a standard model, then the first theorem can be taken to imply, in effect, that there are truths about these objects which cannot follow as theorems from the axioms adopted, no matter what these are, providing only that they are given in a codifiable (recursive) form. If one is already inclined to the view that the notion of mathematical truth is irreducible, then this will support the suggestion that there is some kind of direct intuition, either of mathematical objects themselves, or of mathematical truths. The second theorem makes it clear that the syntactic consistency of a theory cannot be established by a weak meta-theory. One reaction to this is to say that the Gödel results show that acceptability cannot collapse just to the notion of provable consistency, that acceptability is a much more complex affair, and that, although it will be important to obtain indications of consistency wherever possible, features other than this must be involved. Indeed, there is good evidence that Hilbert himself took acceptability to consist in more than mere syntactic consistency; consistency was the focus because this was taken to be the most mathematically tractable element involved.

The Hilbert view, when rounded out, represents a form of *constructivism*, i.e., the broad position that the properties the world and its objects have are properties *we* endow it with. Constructivism comes in many varieties, but one unifying thread might be said to be the taking seriously of the cognitive capacities of the human mind, in particular of the ability to know. Thus, the Hilbert position is constructive because it first reduces questions about the existence of abstract objects to syntactic ones about the consistency of the framework being employed, and then insists that we approach consistency itself by employing a framework provided by reflection on the limits of cognitive capacity. Broadly speaking, there are two kinds of constructivism. The more general type clearly goes back to Kant, and sees the limitations on our cognitive capacity as applying to all our knowledge, even that of the physical world. According to this, we do not see the world as it is in itself, but rather impose various kinds of conceptual structure in representing it, it being asserted that it is impossible to get

behind these representations to the world itself *without* these impositions. This view of constructivism leads to the view that talk of a world in itself makes no sense. In these positions, as in other forms of constructivism, truth is not generally assumed as a primitive, but is rather reduced to something else, something which is taken to be cognitively accessible (at least ideally), like some form of justification, combined with simplicity and/or coherence and/or consistency. (The recent writings of Hilary Putnam are good examples of the network of issues involved in this.)

It is not clear that these positions demand a revisionary attitude to the statements of mathematics. Hilbert's position does not, and Putnam claims that his does not either. Other forms of constructivism, more narrowly mathematical, *are* revisionary and attempt to proceed by building into mathematical theories themselves the limitations that reflection on our cognitive capacities reveals, as opposed to recognizing these limitations only when it comes to the way we deal with formalized mathematical theories (which is, in effect, what the Hilbert position does). One of the crucial ways in which these various forms of specifically mathematical constructivism differ from classical mathematics is through a challenge to the way the latter has, since Georg Cantor, dealt with infinity, in particular the way it deals with infinities as completed (or actual) wholes, instead of just as potentially infinite.

Another way of dividing up the varieties of constructivism is to look at those versions which challenge classical logic, like intuitionism, and those versions which do not. In this regard, intuitionism, the third '-ism', and the creation of the Dutch mathematician L. E. J. Brouwer (1881–1966), has a characteristic attitude towards mathematical objects, coloured by its rejection of the law of excluded middle, of the principle that a statement is equivalent to its double negation, and by its way of dealing with the quantifiers. What gives rise to this, or what goes hand in hand with it at least, is an attitude towards infinite domains which is quite different from the classical way of treating these. Theories akin to the Platonic view consider that the natural numbers, for example, exist independently of us, equipped with all their properties. Thus it is either the case that every even number is the sum of two prime numbers (call this the Goldbach property) or not, *tertium non datur*, regardless of whether it is within our power to know which it is, or even whether it ever will be within our power. Intuitionism rejects this. According to this view, it is quite wrong to think of an even number's possession of the Goldbach property as being a matter which is true or false in advance of it being decided by mathematics. In particular, it asserts that:

1. Objects only exist if we have explicit means of constructing them.
2. Objects only have those properties which we can demonstrate constructively that they have.
3. The negation of a property P is not necessarily a property on a par with the positive property P.

Thus constructed objects like the natural numbers acquire properties through time, and do not automatically possess any property or its negation expressible in the given language. Hence, it will be considered true that 'It is either the case that every even number has the Goldbach property or not' *only* if we have either a uniform method which, given any even number, will yield explicitly two prime numbers summing to the given even number, or we can exhibit an even number which is demonstrably not the sum of two primes. But we have neither of these things, and so the disjunction sanctioned classically by the law of excluded middle is not true. Thus, we cannot automatically assume that any object whatsoever will have a property or its negation. Ascribing properties by existential statements is limited too, for intuitionism will only accept an existential statement as true providing that there is some means given of actually exhibiting an object which has the property concerned. Thus, for intuitionism, an existentially quantified statement is merely a shorthand for the ability to carry out a certain construction.

For the Platonist view, then, mathematics is about a range of objects and their properties, and proof is the means by which we

verify our conjectures about these objects. For intuitionism, this paradigm no longer holds: the object of mathematics is taken to be the means of investigation itself, proof and construction, the latter being constrained by the means of proof. (For one important account of intuitionism, see Dummett 1977.)

Let us turn finally to views which are known as 'structuralist', views which derive, in essence, from Richard Dedekind (1831–1916) and Hilbert, from the former's view that the natural number structure is much more important than the essence or nature of the individual numbers, and from the latter's view that the precise nature of points, lines, and planes in geometry is irrelevant, the important thing being the geometrical structure itself. Very broadly, structuralism can be expressed as the view that talk of mathematical objects always has to be relative to a structure; thus, when we consider the number 3, we are not considering an object which has a life of its own, but rather something which performs a certain function in the structure of natural numbers. The epistemological problems of Platonism *seem* to be avoided with this; for if the nature of the objects is irrelevant, then the problem of how we acquire knowledge of the nature of the putative objects cannot arise. (However, see below.)

Even so, various other problems arise. The first concerns the status of the structures themselves. If mathematics is primarily about structures, then are not these themselves mathematical objects? In the present context, saying that mathematics is about structures and not objects does not, in itself, lead anywhere. Nevertheless, two things are worth pointing out. First, structuralism seems closely related to the position outlined above that we only know of objects because we first know theories, adding to this the view that the aim of theories is to capture structures. Second, the structuralist view is often a hidden way of expressing opposition to set-theoretical reductionism, to the view that all mathematical objects are ultimately composed of sets, and that these are therefore primary in mathematics.

Whatever the attractions of the sentiments which this latter view embodies, there is frequently a need to show that there are instances of certain structures, not least for the purposes of showing the relative consistency of certain theories, and for this one frequently calls upon sets for the basic material. Hence, it seems that this form of structuralism cannot be as independent of set theory as is sometimes claimed. A second major question raised by structuralist views is epistemological: if we think that the aim of mathematical theories is to capture structures, how do we come to know these? A natural explanation is that particular structures are revealed in our operation either with physical or with mathematical theories. (An example might be the group structure.) But this view seems to entail the problems with abstractionism mentioned above. We can acquire knowledge of structures *if* we can abstract from particular instantiations; but to have an epistemology here, surely we need some account of how we abstract.

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MICHAEL HALLETT

Mathematical Structures

Several contemporary philosophers of mathematics hold that mathematics is about structures; we call this type of approach 'structuralism'. From the point of view of traditional ontology, structures are complex universals;

which many systems of objects can instantiate. This idea is not new; for example, David Hilbert expressed the structuralist point of view in describing a theory as only a 'scaffolding' which can be interpreted by any group of objects which exhibit the right structure (letter to Gottlob Frege, 29 December 1899). Thus a given branch of mathematics, like geometry or algebra, can be used to represent any system that satisfies the respective axioms. The structuralist approach has been recently revived, largely in response to a 1965 paper by Paul Benacerraf, "What numbers could not be" (*Philosophical Review*, 74). Benacerraf argued that numbers are not sets on the basis of the fact that there are many ways to reduce the natural numbers to sets, and the plausible claim that there is no relevant reason to choose one over the other. Benacerraf extended this result to conclude that it is wrong to think of numbers as objects. He offered two impressionistic suggestions for positive theses. First, he suggested that numerals are not names of any objects, although mathematical sentences do have truth values. Second, he suggested that what is really of interest in arithmetic is the abstract structure that the theory of numbers characterizes, rather than what sorts of objects the individual numbers are.

Different conceptions of structures and of the ways in which they may be described and known have given rise to a number of variations on the structuralist theme. We shall look at two major formal approaches to the ontological question of the nature of structures.

One type of structuralism can be called the *abstract algebraic conception of structures*. The mathematicians who developed the traditional mathematical theories, the arithmetic of the natural, rational, real and complex numbers, geometry, analysis, equational algebra, and so on, regarded themselves as studying single systems of mathematical objects. Not only were the systems thought of as unique, but also the numbers, geometrical figures, curves, and equations, were thought of as objects in their own right. During the last century mathematicians developed so-called *abstract mathematical theories*, such as group theory, Boolean algebra, and topology, which study whole classes of systems of mathematical objects and draw their examples from the objects studied by the traditional theories. Group theory, for example, is concerned with all groups. It is not unusual to say that group theory studies the *group structure*; the integers under addition constitute but one example of this structure.

At the beginning of this century, the abstract conception exemplified in group theory began to be extended to geometry and analysis. Today we might describe this by saying, for example, that Euclidean geometry is the theory of all Euclidean spaces, or that real number theory is the theory of all real closed fields. In *Was sind und was sollen die Zahlen?* of 1888, Richard Dedekind (1831–1916) characterized the number structure and proposed that the numbers are just any system of things that satisfy that characterization. Other than this, an approach of this sort was not extended to numbers, functions, or sets until recently.

In recent responses to Benacerraf's structuralist suggestion, philosophers of mathematics have suggested that the theory of the natural numbers be conceived on the model of group theory. For example, in 1974, in his "What numbers are" (*Synthese*, 27) Nicholas White suggested that number theory is the theory of all progressions, where a progression is any system exhibiting the structure of the natural numbers beginning with zero. A numeral does not refer to any object absolutely but only in the context of a progression: given a particular progression, the numeral '2' refers to whatever stands in the third place in that progression. By extending these ideas to other axiomatic theories, we can see that the structuralist approach is generally applicable to all branches of mathematics. A given mathematical theory on this view focuses on all the systems of objects that satisfy that theory. The theory is a description of the structure shared by these systems. The abstract algebraic conception remains agnostic as to whether any mathematical structures are exemplified at all, and thus whether any mathematical theory is non-vacuously true. In the end it is a form of deductivism.

A second, contrasting view of mathematical structuralism finds its conceptual roots in what Charles Parsons has called *the incompleteness of mathematical objects*. This is the idea that mathematical objects have no distinguishing features in themselves beyond those accruing to them by virtue of their relations to other mathematical objects of their kind. Thus the natural number 2 can be distinguished from 3 by being a divisor of every even number, but the natural numbers can be distinguished from progressions of sets or points only circularly by appealing to the property of being a number rather than a set or point. We can put this idea more technically by noting that we distinguish and identify mathematical objects by means of properties definable in our best theories of them. We have no better theory of a system of mathematical objects than a categorical one, that is, a theory all of whose models are isomorphic. But no theory is able to distinguish between its models. Thus the best we can do is describe mathematical objects up to isomorphism.

A natural response to this is Michael Resnik's *pattern structuralism*, the view that mathematical objects are nothing but *positions* in patterns or structures. Hints of the view may be found as early as the writings of C. F. Gauss (1777–1855) (*Werke*, X/1, pp. 396–7, and II, pp. 169–78). Gauss described mathematics as the science of relations, where the mathematician abstracts from any particular qualities of objects keeping only structural properties of the relations holding between the objects. In contrast with the abstract algebraic conception of structures, Resnik's account is a form of mathematical realism. Mathematical objects exist as positions or elements in structures. Each mathematical object is like a geometrical point in having no distinguishing features but those determined by its relationships to other objects in its structure. Mathematical objects with apparent internal structure, like sets, vectors, or spaces, can be fitted into this view by construing them as termini of the various relations in which they stand. For example, instead of taking sets as composed of or constituted by their members, this view sees them as simply positions in the hierarchical structure(s) determined by the membership relation.

One consequence of the incompleteness of mathematical objects embodied in pattern structuralism is a kind of *ontological relativity*: there is no fact of the matter as to whether a position in one structure is identical to that in another unless the former is a substructure of the latter. Resnik argues from this that there is no fact of the matter as to whether two separately occurring isomorphic patterns are identical. The solution to the problem posed by Benacerraf's paper falls out of this, as there is a problem only for those who think that there should be a fact of the matter as to whether numbers are sets and whether they are these sets rather than those.

On the pattern structuralist view, treating patterns themselves as mathematical objects requires seeing them as positions in some very large pattern of patterns, call it P. Yet there is no fact of the matter as to whether a pattern given outside of P is itself a position of P. So it is not clear in what sense pattern P is a pattern of all patterns or how the theory of pattern P can study all patterns. It may be that, on its own saying, this variety of mathematical structuralism cannot be expressed as a fully-fledged mathematical theory and that, in *Tractarian* terms, it attempts to say what can only be shown.

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MICHAEL D. RESNIK AND LILA LUCE

Meaning I: Naturalistic Theories

Plato states the fundamental question about the nature of words and their meanings in his dialogue *Cratylos*. He advocates a partially

naturalistic conception of the meanings of words, a conception which embraces their non-arbitrary, instrumental character. The metaphysical positions of Plato and Aristotle establish basic paradigms for the interpretation of the relation between 'ideas' and 'individual forms' as correlates of linguistic signs. A first classification of primary types of meanings is given in Aristotle's list of categories, which distinguishes nine sorts of secondary substances (*quantity, quality, relation, where, when, position, possession, effected*, and *affected*). The topic of a universal architecture of meanings is thus introduced and Aristotle's work constitutes the beginning of a tradition of work on meaning in which a parallelism between ontological and conceptual categories is postulated.

The existence of universals was the object of a debate in medieval times which opposed the *realists* (*universalia sunt realia ante rem*) and the *nominalists* (*universalia sunt nomina post res*). A radical nominalism, which doubts the fundamental fitting of concepts to ontological structures is, however, a modern development.

Following the developments of mathematics and natural philosophy by Galileo, Johannes Kepler (1571–1630), and Sir Isaac Newton, empiricist philosophies of mind and language were developed by John Locke and Etienne Bonnot de Condillac (1715–80). Locke postulated a fully-fledged system of ideas pre-existent to language, which is transported between individuals by the technique of signs. Condillac acknowledges the constitutive role of signs, which allow for a level of cognitive organization beyond that of animals. The dependence of the mind on language and the social character of the latter lead directly to Wilhelm von Humboldt's (1767–1835) linguistic relativism (a precursor of the so-called Sapir-Whorf hypothesis). In general the 18th century gave rise to a fan of approaches from naturalistic (biological and genetic) theories to cultural theories of meaning.

Modern Theories of Meaning. Modern theories are extensions of these traditions. Thus empiricist theories have been continued by the neo-behaviourists such as C. E. Osgood (a strict behaviourist would eliminate the term 'meaning') and by logical empiricists in the wake of Gottlob Frege. The latter eliminate the cognitive or psychological aspects of meaning and propose instead a formal ontology of objectivized meanings as the basis for the referential function of linguistic signs. Later intensional logic introduces a very poor concept of conceptual meaning (intensions) and in situation semantics the holistic interpretation of sentences by means of truth-values (as in Frege) is reduced to a type of partial, situational interpretation (cf. Barwise and Perry 1984). The Platonism of logical semantics is also characteristic of representational theories in the domain of artificial intelligence. A radical wing maintains even the identity of minds and machines. For these theories formal or computer-derived considerations have absolute priority and no relation to the outer world and the categorization imposed by it, or the functional dependence on it, is considered (except a general utilitarian relation to possible applications of the models proposed). The subjacent ontology remains implicit and metaphysical questions are mostly ignored.

A new innovative development is due to the consideration of internal sources of structure in *systems* of meaning. A series of proposals taking systematic contrasts (oppositions), field-like interdependencies, prototypes, and metaphorical processes as basic schematisms, has revealed a rich self-organization inside the world of meanings. Internal self-regulatory mechanisms thus play a prominent role, where external (biological and social factors) define rather the domains and limits of meaningful signs.

Possible universal principles, scales, and schemata were proposed in the framework of René Thom's natural philosophy. Applying recent results of dynamic systems theory (catastrophe theory, synergetics, chaos theory), the morphological continuity between physical, physiological, and symbolic processes and entities may be formulated. This semantics may be considered as an alternative to or possibly as a completion of situation semantics, as both assume some continuity between the external and the internal world in the sense of psychophysics. The connection of semantics in Thom's line

to the tradition of logical semantics, however, calls for further elaboration. A synthesis of both traditions, the topological and the logical one, may lead to much deeper insights into the nature of meaning, which is one of the most fundamental concepts for our understanding of the world and ourselves.

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WOLFGANG WILDGEN

Meaning II: Literal Meaning and Semantic Theories

The notion of the *literal meaning* of expressions of public language has played a major role in recent philosophy, particularly following the work of Paul Grice and Donald Davidson. (The relevant papers by these two authors are collected in Grice 1989 and Davidson 1984 respectively.) It is widely agreed that the total communicative significance of a linguistic act is the product jointly of the literal meanings of the expressions used, and of contextual factors. An account of this interaction is the business of *pragmatics*.

Literal meaning has been a focus of philosophical attention in two ways, corresponding to two different senses of the phrase 'theory of meaning'.

Elucidation and Specification. On the one hand, there are theories about the nature of linguistic meaning. Typically, these are informal, discursive theories. On the other hand, there are theories in which we can systematically derive the meanings of the sentences of some particular language. In principle, these are formal, axiomatized theories; and it is usual to suppose that the number of axioms is finite. Theories of the first kind provide *elucidation* of the concept of meaning itself; theories of the second kind provide *specifications* of the meanings of the sentences of a given formal or natural language.

There can be no doubt of the philosophical character of theories of the first kind. For they are attempts at conceptual illumination, or even analysis. Thus, for example, the programme begun by Grice, and continued by Jonathan Bennett, David Lewis, Stephen Schiffer, and P. F. Strawson, aims at an analysis of the concept of public language meaning in terms of psychological concepts such as intention and belief.

That analytical project can be regarded as having two stages. The first stage aims to characterize a concept of *speaker's meaning* that corresponds to the idea of communicating, or attempting to communicate, a proposition. The second stage then aims to use that concept of speaker's meaning, along with the notion of a *conventional regularity*, to construct an analysis of the concept of literal linguistic meaning. Very roughly, and ignoring contextual factors, the idea is that a sentence has as its literal meaning the proposition that it is conventionally used to communicate.

Non-circularity in this analysis requires that the accounts of speaker's meaning and of conventional regularity should themselves be provided without recourse to linguistic notions.

Whatever its particular merits and drawbacks, and its epistemic and ontological commitments, this is a familiar kind of analytical project, analogous to philosophical accounts of knowledge, personal identity, or free will.

In contrast, it may not initially be clear why theories of the second kind – which specify meanings rather than elucidate what meaning is – have significance for philosophy and not just for linguistics and formal logic.

Systematic Specifications of Meaning. There are several reasons for focusing philosophical interest upon the construction of systematic *semantic theories* – theories that specify meanings. At least four are revealed in Davidson's work.

Format. First, there are arguments over the proper format for the deliverances of a semantic theory. The obvious format for theorems that specify meanings might seem to be

the meaning of sentence s is m

if meanings are regarded as entities, or else

sentence s means that p.

But Davidson rejects both these, and argues instead for the truth conditional format

sentence s is true if and only if p

in which 'if and only if' ('iff') expresses the material biconditional.

Davidson's argument is in two stages. The first stage is intended to rule out the idea that, to each primitive expression and each sentence, there should be assigned some entity as its meaning. In this stage, the so-called *Frege argument* is used to show that, under certain assumptions, all true sentences would be assigned the same entity. Since no such undiscriminating assignment of entities could be an assignment of meanings, this is supposed to confirm that "the one thing meanings [as entities] do not seem to do is oil the wheels of a theory of meaning" (Davidson 1984, p. 20).

The second stage of the argument points out that the 'means that p' construction presents logical difficulties, so that the formal derivations of specifications of meaning will be highly problematic. In contrast, the truth conditional format is logically well understood; and derivations of truth condition specifications can, to a considerable extent, be carried over from Alfred Tarski's (1956) work.

This second stage of the argument is technical in character, and it is a matter of dispute whether a systematic semantic theory making direct use of the 'means that p' construction is feasible.

The status of the first stage of the argument is more widely agreed. There are reasons for rejecting Davidson's use of the Frege argument, and for admitting the possibility of a systematic theory that assigns to each sentence a structured entity – in particular, a state of affairs with objects and properties as constituents – as its semantic value. The situation semantics programme of Jon Barwise and John Perry (1983) constitutes one development of this possibility.

Adequacy. Second, there are arguments about the conditions of adequacy for a systematic theory that specifies meanings. Whatever the format of the theorems of a semantic theory, we need some account of the conditions under which it is the correct theory for the language of a particular group of speakers.

An account of the nature of the key semantic concept used in the theory, such as meaning or truth, clearly furnishes a condition of adequacy. Thus, suppose that a putative elucidation of the nature of meaning says that any sentence s has meaning m in the language of population P if and only if condition $C(s,m,P)$ holds. Then a systematic theory of meaning for the language of P should meet the following condition of adequacy: if the theory delivers the consequence that

the meaning of sentence s is m

then it should be the case that $C(s,m,P)$.

Conversely, any condition of adequacy upon a systematic semantic theory may contribute towards an account of the nature of the key semantic concept employed in that theory.

For example, Tarski's *Convention T* (Tarski 1956) imposes a condition of adequacy upon semantic theories that adopt the truth conditional format

s is true iff p;

namely, that the sentence that fills the 'p' place should translate the sentence s. This condition of adequacy constitutes a partial elucidation of the semantic concept of truth in terms of the concept of translation. However, the concept of translation involves the concept of meaning. What Convention T requires is that the sentence that fills the 'p' place should have the same meaning as the sentence s. So the elucidation of the semantic concept of truth comes to this: if a sentence s means that p then s is true iff p. But Convention T provides no help with the concept of meaning itself.

In Davidson's programme, light is shed upon the notion of linguistic meaning in

general by describing the constraints upon the project of *radical interpretation*: the imaginary project of constructing an overall scheme of interpretation for speakers about whom one knows nothing at the outset. There are constraints that govern the use of the deliverances of a semantic theory in interpreting the linguistic behaviour of speakers; and these constraints indirectly provide elucidation of the concept of meaning.

In Davidson's early papers, the main constraint is the Principle of Charity: speakers should be so interpreted that what they say and believe about the world is by and large correct. In later work by Davidson and others, this is supplanted by the Principle of Humanity: speakers should be so interpreted that what they say and believe about the world is by and large reasonable. The goal is that of making the best possible sense of the speakers – of rendering their conduct intelligible.

Epistemology. There is a third reason for philosophical interest in the construction of systematic theories that specify meanings. Someone who knew the finitely many facts stated by the axioms of a semantic theory for a particular language would be in a position to know the meaning of each of the infinitely many sentences of the language. Semantic theories thus shed light on an epistemological problem: how is it possible for a finite being to master an infinite language?

Indeed, Davidson uses the requirement of learnability of languages to motivate the constraint upon systematic semantic theories – and in particular, upon theories of truth conditions – that they should be finitely axiomatized. On the other hand, though, Schiffer (1987, Chapter 7) argues that it is possible for a speaker to master a language, even though no finitely axiomatized theory of truth conditions can be provided for it.

Although knowledge of a theory that specifies meanings would suffice for understanding a language, ordinary speakers of a natural language lack conscious knowledge of any systematic semantic theory for their own language. This raises the question of how the mere existence of a semantic theory, unknown to ordinary speakers, can solve the epistemological problem that the speakers apparently face. One response to this problem is to credit speakers with *subpersonal* or *tacit* knowledge of a semantic theory, or with some other kind of *implicit* knowledge. Another response is to see the construction of semantic theories as a matter of *rational reconstruction*. Some versions of the first response promise a close link between philosophy of language and cognitive science. But this is no part of Davidson's project; indeed, it is not clear that he intends either style of response.

Ontology. A fourth focus of philosophical interest is provided by the way in which the task of bringing specific linguistic constructions within the scope of a systematic semantic theory may shed light upon issues in metaphysics or the philosophy of mind.

Thus, for example, in recent philosophical work there are close links between the semantics of names, definite descriptions, and modal operators, on the one hand, and metaphysical issues about necessity and essentialism, on the other. A key claim in this area has been that proper names are *rigid designators*: a name, unlike a description, designates the same object with respect to different possible situations.

Also, questions about the semantics of demonstrative and indexical constructions highlight issues in ontology and the philosophy of mind – concerning Fregean senses, for example.

Davidson's own work provides a clear example of the way in which the construction of a semantic theory may reveal the metaphysical commitments of the conceptual scheme that is expressed in a natural language. Davidson (1967) argues that a semantic theory for adverbially modified action sentences such as

> John buttered the toast slowly, in the bathroom

must discern quantification over, and predicates of, events.

Elucidation and Analysis. It is an empirical question whether a systematic semantic theory is adequate for the language of a given group of speakers. Equivalently, it is an

empirical question whether the language (in the abstract) for which a semantic theory is stipulated to be correct is the *actual language* of a given population.

Since this is an empirical question, a putative specification of meanings for a language in use will – on any account – be evaluated in the light of empirical evidence. But Davidson's proposal is a bold one. The claim is that, by spelling out the way in which a putative scheme of interpretation – including a specification of meanings for sentences – is empirically confirmed, one provides all the philosophical elucidation that can be provided of the concept of meaning.

The Principle of Humanity constrains specifications of meaning only to the extent that we have some account of which combinations of meanings, speech acts, and propositional attitudes can contribute to making the best sense possible of the total life and conduct of speakers. But Davidson does not provide any explicit account of this.

On the face of it, an account of which combinations are coherent would be provided by articulating the constitutive connections amongst the concepts of meaning, of the various speech acts, and of the propositional attitudes. The proposal of Grice's programme is that these *a priori* connections permit the analysis of the notions of meaning, and of the various speech acts (Schiffer 1972, Chapter 4), in terms of propositional attitudes, centrally belief and intention.

The first stage of the analytical project begins with a distinction between *natural* and *non-natural* meaning (Grice 1989, p. 214). Natural meaning might also be called *indicator* meaning; and examples of its use are provided by (e.g.):

Those spots mean (indicate) measles.
Those clouds mean (indicate) rain.

This notion is not the concern of Grice's programme, though it takes on considerable importance in recent attempts to provide a naturalistic account of the semantic contents of psychological states themselves.

Speaker's Meaning. The notion to be analysed is that of non-natural meaning; and, in particular, that of a speaker (utterer *U*) meaning something by his or her utterance *x* directed at an audience *A*. The putative analysis offered by Grice in early papers is as follows (1989, p. 92):

U uttered *x* intending
1. *A* to produce a particular response *r*.
2. *A* to think (recognize) that *U* intends 1.
3. *A* to fulfil condition 1. on the basis of his fulfilment of condition 2.

In the case where the speaker is attempting to communicate the message that *p* to the audience, the primary intended response in clause 1. is that *A* should believe that *p*. The utterance type that is employed might or might not have a literal linguistic meaning; and if it does then the communicated message might or might not coincide with that literal meaning. But, crucially, this analysis of speaker's meaning does not itself make use of the notion of literal meaning, and so is available for deployment in a non-circular analysis of that notion.

A host of revisions and extensions have been visited upon Grice's initial three-clause analysis. These tend in the direction of making the analysis more complex, and consequently face the challenge that they render it psychologically implausible that ordinary speakers often produce utterances with the requisite intentions. However, it is open to an advocate of Grice's overall programme to stress that the notion of speaker's meaning primarily serves as a staging post *en route* to an analysis of literal linguistic meaning. If it fills that role successfully then it matters little whether it corresponds perfectly to any antecedent idea of communicating a message.

Conventional Meaning. Grice (1989, p. 126) suggests moving from speaker's meaning to literal meaning via the notion of "having a certain procedure in one's repertoire". But most recent work in the Gricean tradition makes use of the notion of a *convention* as a rationally self-perpetuating regularity in behaviour.

According to Lewis (1975, pp. 164–6) a convention is a regularity *R* in action, or in action and belief, which meets the following conditions:

1. everyone conforms to R;
2. everyone believes that everyone else conforms to R;
3. the belief in 2. furnishes each person with a reason to conform to R;
4. there is a general preference for general conformity to R, rather than slightly less than general conformity;
5. there is at least one alternative regularity which would serve reasonably well;
6. the facts listed in 1.–5. are matters of *common knowledge*.

The most straightforward way to employ this notion and that of speaker's meaning in an analysis of literal linguistic meaning is to say that a sentence s literally means that p iff there is a convention in the population in question to use utterances of s in order to communicate that p (that is, in order to mean that p, in the sense of speaker's meaning). But, quite apart from the problem that it ignores the ambiguity and context-dependence of natural languages, this suggested analysis imposes a requirement that is far too strict to be a necessary condition for literal meaning. Consequently the analyses of literal meaning suggested by recent theorists all depart in one way or another from this most obvious way of pursuing the second stage of Grice's programme. These accounts still present the use of a public language as a psychologically highly complex matter; but the psychological plausibility of such accounts has been defended (Loar 1981).

Expression Meaning and the Structure of Language. The way in which the literal meaning of a complete sentence is built up from the meanings of its constituent expressions is the starting-point for Davidson's project in the philosophy of language. But the analysis of literal meaning for expressions smaller than complete sentences is a difficult problem (which is not to say an insoluble one) within Grice's programme.

In essence, the problem is that the structure of language presents a dilemma for the general idea that literal meaning is a matter of there being conventions to use expressions with certain intentions. The primary link between meaning and convention has to be made either at the level of atomic expressions (such as names, predicates, and quantifier expressions) and primitive modes of combination, or else at the level of complete sentences.

On the first alternative it is practically inevitable that the account of meaning will involve attributing to ordinary language users beliefs and knowledge that they do not have: detailed beliefs and knowledge about the constituents and construction of their sentences.

The obstacle to the second alternative is that there are many sentences that are never used at all, and many that would never be used to communicate the proposition that is their literal meaning. An example of the latter kind is provided by the sentence:

> No head injury is too trivial to be ignored (Bennett 1976, p. 17).

This sentence is sometimes used; but it is typically used with the intention that the hearer should believe that no head injury is *sufficiently* trivial to be ignored.

A possible response to this dilemma is to suggest that an account of literal meaning applicable to all sentences – whether used or not – should explicitly advert to the psychological mechanisms that underpin the use of some core set of sentences.

One way of implementing this response would be via Chomsky's notion of an internalized *grammar*. Indeed, Loar (1981, p. 259) suggests that "the Chomskyan idea of the internalization of the generative procedures of a grammar has got to be invoked to . . . make sense of literal meaning". And, in a less optimistic vein, Schiffer (1987) argues that the Gricean analytical programme has failed, and wonders whether "the answer lies in some alliance with cognitive science" (p. 271). But we do not have any detailed prospectus for an interdisciplinary marriage between Chomsky's and Grice's rather different projects; nor is it obvious how much that is distinctly Gricean could survive the union.

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MARTIN DAVIES

Measurement

Measurement is the denoting of *quantities* by *numbers*, e.g. the denoting of the length of a stick by the number 2, namely the measuring value of 2 metres. It implies an application of mathematics to quantities.

Three ontological views of measurement can be distinguished: the *traditional view* (still to be found in Mally 1904, which gives a very elaborate Meinongian ontology of measurement), the *modern realist view* (Russell 1937, Rozeboom 1966, Berka 1983) and the *modern positivist view* (Ellis 1966, Suppes and Zinnes 1963).

The main difference between the traditional and the modern views is over the connection between numbers and quantities. In the former it is closer. Traditionally the connection is assimilated to that between subject and predicate. A quantity *has* a number as magnitude. Correspondingly, numbers are considered to be essentially magnitudes of quantities and mathematics the science of magnitudes. While in the traditional view the connection between quantity and number is close and *natural*, in the modern views it is loose and merely *conventional*, established principally by our choice of a unit for a quantity kind (as e.g. the prototype metre rule in Paris). According to the latter, a quantity does not have a number independently of human thinking. Rather, we use numbers to *represent* quantities perspicuously.

Though the two modern views agree on the relation between number and quantity, they disagree with regard to the nature of number as well as of quantity. For the realist, numbers are entities and arithmetic deals with objective laws; whereas for the positivist numbers are mere symbols and arithmetic establishes only the rules for using them.

The positivist denies that there are absolute quantities, i.e. that one thing can have a quantity irrespective of other things. He is a *relativist*. He holds that there are only quantitative relations and that a thing can have a quantity only relative to another thing, relative to the chosen unit. However, the realist is an *absolutist*. He assumes for each quantity kind a *series of quantities* which are properties, non-relational properties. The series are formed and ordered by the quantitative relations 'greater' or 'less'. Thus, the realist considers the quantitative relations to hold between quantities, not between the thing having the quantities. Since numbers are also serially ordered, he can conceive of measurement as a correlation of number series and quantity series, i.e. of assignment of numbers to quantities in such a way that the two series correspond.

The positivist, too, assumes a quantitative series corresponding to a number series. However, his quantitative series does not consist of quantities, but of things, e.g. not of lengths but of oblong objects. Consequently, numbers cannot be assigned to quantities, but to concrete objects. The assignments of numbers connected with measurement are usually called *scales*. Comparing the realist and the positivist view, one notices that according to the former scales refer to quantities, according to the latter to things. Things change, quantities do not. Hence, the positivist view, unlike the realist, implies a frequent change of scales, e.g. of the metre scale when things shrink or expand.

The realist considers quantitative relations

between things as derived from those between quantities, e.g. 'heavier' as the relation 'having a greater weight quantity'. Thus he can distinguish between quantitative relations and relations which are outcomes of measurement operations, e.g. between 'heavier' and 'outweighs on a beam balance' and, in accordance with the usual practice of the physicist and the technician, between measured value and true value of a thing for a quantity kind. True values are defined by quantitative relations to unit objects, e.g. 'weighing 15 kilograms' as 'having the same weight quantity as the spatial whole of fifteen objects having the same weight quantity as the standard kilogram' which is kept as constant as possible. Where measured value and true value do not coincide, there is *measurement error*.

The positivist cannot form the concept of measurement error and therefore he cannot explicate the usual practice. His quantitative relations are *operational*, i.e. nothing but results of measuring operations, e.g. his relativist analysis of the quantity kind weight would not draw on the relations 'heavier' and 'equally heavy', but on 'outweighs on a beam balance' and 'balances on a beam balance'. The operationalist analysis leads also to a multiplication of quantity kinds, because there are always several alternative measuring operations, e.g. the positivist would have to differentiate beam balance weight and spring balance weight. Ellis wants to avoid this consequence by identifying a quantity kind with a series of the things having a quantity of the kind (Ellis 1966, p. 32). But the generating relation is always a constituent of a series. Thus no diminuation of the number of quantity kinds would ensue. In addition, Ellis's suggestion to view similar series of the same things as one and the same quantity kind, would lead to the identification of correlated quantity kinds.

Since the relativist and operationalist approach in a way dissolves quantities, adherents of the positivist view tend to shift quantitativeness to the assignments of numbers, which means that it is man-made, that there is a process of *quantification*, of creation of quantities by us, that quantitativeness is produced by the construction of scale. The realist, in contrast, insists that quantities exist independently of our thinking (hence his name).

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ERWIN TEGTMEIER

Meinong, Alexius I: Meinongian Semantics

Alexius Meinong (1853–1920), a student of Franz Brentano, was a philosopher-psychologist whose all-encompassing ontological theory of the objects of thought is summarized in the motto, 'There *are* objects that do not *exist*'. The theory was at first welcomed by Bertrand Russell ("Meinong's theory of complexes and assumptions", *Mind*, 1904) but then rejected by him (*Mind*, 1905 and 1907) and thereafter by the majority of philosophers outside Meinong's own so-called 'Graz School'. Meinongian theories, revived and formalized in the 1970s to provide foundations for natural-language semantics and intentional theories of mind, have recently been applied to related problems in artificial intelligence.

The Theory of Objects. The theory of objects is based on the act-content-object analysis of psychological experiences: a psychological experience (e.g., my judging that Santa Claus is skinny) is analysed into an *act* (judging), an *object of* the act (that Santa Claus is skinny), and a *content*, which 'directs' the act towards its object. This is expressed as:

(T1) *Thesis of Intentionality*: Every psychological experience is 'directed' towards an 'object' (*Gegenstand*).

There are two kinds of Meinongian objects:

1. the *objectum* (*Objekt*), the individual-like object of a mental act such as presenting or thinking-of (*Vorstellen*);

and

2. the *objective* (*Objektiv*), the proposition-like object of a mental act such as believing(-that) or knowing(-that).

Thus, for example, the objectum of my act of thinking of Santa Claus is *Santa Claus*; the objective of my act of believing that Santa Claus is skinny is *Santa Claus is skinny*.

In Meinong's deliberately "paradoxical means of expression, there are objects of which it is true that there are not such objects" (Meinong, *Gesamtausgabe* (= GA), Volume 2, p. 490):

(T2) Not every object has being (*Sein*).

I.e., there are objects that neither exist nor subsist, where (a) existence (*Existenz*) and subsistence (*Bestand*) are the two 'degrees' of *Sein*, and (b) 'there are' ('*es gibt*') has no existential or subsistential commitment.

Two related theses are:

(T3) It is not self-contradictory to deny *Sein* of an object, nor tautologous to affirm it;

and

(T4) *Thesis of Aussersein*: All objects are *ausserseiend* ('beyond being and non-being').

By (T3), *being* and *existing* are meaningful predicates of objects. *Aussersein* is best explicated as a domain of quantification for quantifiers that have no existential commitments.

Meinong's recognition of non-existing objects commits him to ascribing properties to them as well as to existing ones. Some such properties will be essential, others non-essential; the (set of) essential properties of an object is its *Sosein*, and Meinong embraces the thesis:

(T5) Every object has *Sosein*.

The properties constituting an object's *Sosein* may be truly predicated of an object, whether or not the object has *Sein*. This was formulated by Meinong's student, Ernst Mally, as the thesis:

(T6) *Principle of the Independence of Sosein from Sein*: Theses (T2) and (T3) are not inconsistent.

A corollary of this is that even objects with *Nichtsein* (i.e., without *Sein*) – e.g., objects that do not exist – have *Sosein*.

Another important thesis (GA, Volume 5, pp. 197–365) is:

(T7) *Principle of the Freedom of Assumption*: (a) every *Sosein* corresponds to an object, and (b) every object can be thought of (relative to psychological limitations).

Thesis (T7), together with the fact that there is no qualitative difference between the *Sosein* of objects that have *Sein* and those that do not, permits an account of how we can think and speak uniformly about fact as well as fiction.

An object o is incomplete if and only if there is a property F such that o is neither F nor not F. Meinong now embraces a thesis to the effect that:

(T8) Some objects are incomplete.

By taking a and b to be incomplete objects each of which lacks some property had by the other, the theory can account for how one can believe that a has property F without believing (or being committed to the belief) that b has F, even when a and b are said to be the same entity.

Our next thesis is:

(T9) The meaning (*Bedeutung*) of every noun phrase or sentence is an object.

This provides 'referents' for all 'non-referring' expressions, allowing Meinong's theory to serve as a foundation for a fully intensional, natural-language semantics and a 'free' logic (cf. T. Parsons 1980, K. Lambert 1983).

Meinong's theory was attacked by Russell on grounds of inconsistency. According to Meinong, the round square is both round and square; yet, according to Russell, if it is round, then it is *not* square. Similarly, the existing golden mountain must have all three of its defining properties: being a mountain, being golden, and existing; but, as Russell noted, it does *not* exist. The following sections briefly outline recent formalizations of Meinongian theories that overcome these problems.

Castañeda's Theory. Hector-Neri Castañeda's theory of guises (1974) embodies theses corresponding to (T1)–(T9). It is a fully intensional theory with one type of object: *guises* (intensional objects corresponding to sets of properties), and one type of property. There are properties (e.g., *being round, being square*); sets of these (called *guise cores*, e.g. {*being round, being square*}); and an ontic counterpart, *c*, of the definite-description operator, which generates guises (thus, *c*{*being round, being square*} is the guise *the round square*). Guises can be understood as things-under-a-description, 'facets' of (physical and non-physical) objects, 'roles' that objects play, or, in general, objects of thought. They are, however, not (merely) mental entities, but external objects, to which thoughts can be directed and of which other external objects are constituted.

Parsons's Theory. Terence Parsons's theory of non-existent objects (1980) has only one type of object (intensional ones) and only one mode of predication. But it has two types of property: *nuclear* and *extranuclear*. Nuclear properties include all 'ordinary' properties, e.g., *being red, being round*. Extranuclear properties include such properties as *existence, being impossible*, etc. To every set of nuclear properties, there corresponds a unique object that has only those properties. Existing objects must be complete and consistent, but not all complete and consistent objects exist. E.g., *the Morning Star* does not exist (if it is taken to consist of only two properties, as above). *The round square* is (and only is) both round and square and so is not non-square; but it is for that reason impossible, hence not real. As for *the existing golden mountain*, since *existence* is extranuclear, the set of these three properties does not have a corresponding object. However, for each extranuclear property, there is a 'watered-down' nuclear one, and there *is* an existing golden mountain that has the watered-down nuclear property of existence; but *it* does not have the *extranuclear* property of existence, so it does not *exist*.

Rapaport's Theory. William J. Rapaport's Meinongian theory (1978) has two types of objects: *M-objects* (i.e., the objects of thought, which are intensional) and *actual objects* (which are extensional). There are two modes of predication of properties to these: M-objects are *constituted* by properties, and both M- and actual objects *exemplify* properties. E.g., one of my pens is an actual object that *exemplifies* the property: *being purple*. When I think about that pen, the object of my thought is an M-object that is *constituted* (in part) by that property. The M-object *Andrea's pen* can be represented as: *<belonging to Andrea (A), being a pen (P)>*. *Being a pen* is also a *constituent* of this M-object: $P \subset \langle A,P\rangle$; 'Andrea's pen is a pen' is true in virtue of this objective. In addition, $\langle A,P\rangle$ *exemplifies* (ex) the property: *being constituted by two properties*. There might be an actual object, α, corresponding to $\langle A,P\rangle$, that *exemplifies* the property of *being a pen* (α ex *P*) as well as (e.g.) the property of *being black*. But *being black* $\not\subset \langle A,P\rangle$.

The M-object *the round square*, $\langle R, S\rangle$, is constituted by precisely two properties: being round (R), being square (S). 'The round square is round' is true in virtue of this. 'The round square is not square' is false in virtue of it. But $\langle R,S\rangle$ exemplifies neither R nor S, and 'The round square is not square' is *true* in virtue of *that* fact. That is, 'is' is ambiguous.

An M-object *o* exists if and only if some actual object α is '*Sein*-correlated' with it. (A *Sein*-correlate of *o* is an actual object that exemplifies all the properties that *o* is constituted by.) In this sense even incomplete objects such as $\langle A, P\rangle$ can exist. However, the M-object *the existing golden mountain*,

$<E,G,M>$, does not exist (as a matter of empirical fact), even though it has the property of *existing* (because E c $<E,G,M>$).

Routley's Theory. Richard Routley's theory of items (1979), inspired by both Meinong and Thomas Reid, is opposed to the 'ontological assumption' that truth and meaning depend only on reference. By contrast, Routley's *noneism* is 'a very general theory of all items whatsoever' (Routley 1979, p. 5).

Minimal noneism consists of seven Meinongian theses:

(M1) Everything, whether thinkable or not, is an object.
(M2) Many objects do not exist.
(M3) Non-existent objects are constituted in one way or another.
(M4) Existence is not a characterizing property of any object.
(M5) Every object has the characteristics it has irrespective of whether it exists.
(M6) An object has those characterizing properties used to characterize it.
(M7) Important quantifiers conform neither to the existence nor to the identity and enumeration requirements that classical logicians impose.

Basic noneism adds:

(M8) Universals do not exist but they are something.
(M9) It is false that whatever can be conceived is possible (Routley 1979).

To noneism's primarily ontological theses, the theory of items adds theses that are primarily linguistic or semantic. Thus for example it adds a *significance thesis* to the effect that very many sentences whose subjects do not refer to entities are significant independent of the existence, or possibility, of the items they are about. Here the significance of a sentence is a necessary condition for its expressing a statement of any sort, consistent or inconsistent, true or false. Routley also embraces what he calls a *content thesis*: many different sorts of statements about non-existent items are truth-valued. Hence, there are no truth-value gaps, since the gap theory depends on the assumption that all objects exist, which is false in view of (M2). Rejection of the ontological assumption is the essence of the theory of items and is embodied in the *basic independence thesis*: that an item has properties need not imply, or presuppose, that it exists or has being. The *advanced independent thesis* states that non-entities (can and commonly do) have a more or less determinate nature. Finally, the *characterization postulate* states that 'non-entities have their characterizing properties' (cf. M6).

See also: **Guise Theory; Logic V.**

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Meinong, Alexius II: Meinong and the Graz School

The Graz School was founded by Alexius Meinong (1853–1920) around the turn of the century and embraced such notable thinkers as Stephan Witasek (1870–1915), Vittorio Benussi (1878–1927), France Veber (1890–1975), and Ernst Mally (1879–1944). Its influence extended not only through Austria and Germany but also into Italy and Slovenia and into the English-speaking world, where Meinong's influence made itself felt especially in Bertrand Russell's theory of descriptions. In the period beginning around 1920 the school dwindled in importance and

influence. In the 1960s, however, philosophers began once more to discuss the work of the school, both from a historical and also from a systematic point of view, especially in connection with the development of so-called 'free logics'.

Theory of Objects. Meinong criticizes constantly the 'prejudice in favour of the actual' which he claims to find in most standard philosophy (see Meinong, *Gesamtausgabe* = *GA*, II, p. 484). There are, he claims, vast realms of non-actual objects, or of objects "beyond being and non-being":

> The object is in every case something prior as compared to our experience thereof... It is for this reason that experience can never create an object, or even modify it, but merely as it were select it from the manifold of the... pre-given (*GA*, VII, p. 43).

Objects correspond not only to presentations but also to judgements and assumptions. In the former case we have to deal with objects in the narrower sense; in the latter case with certain 'objects of higher order' which Meinong calls 'objectives', distinguishing between *objectives of being* (of the form *A is*) and *objectives of so-being* (*A is B*). Both sorts of objectives may apply or not apply to an object independently of each other, for even non-existent objects have certain properties. This leads to the 'principle of the independence of so-being from being', a principle of importance today not only in work on free logics or 'logics without existence assumptions', but also in the field of Meinongian semantics.

Psychology was seen by the members of the Graz School as fundamental to their enquiries, and members of the school are to be counted among the earliest practitioners of experimental psychology. Meinong himself established the first psychological laboratory in the Habsburg Empire in 1894 and his associates carried out there what have since come to be regarded as classical experiments in the psychology of perception. They may be regarded above all as precursors of the Berlin School of Gestalt theory, and in this connection it is worth remembering that Meinong's most notable student – though he is not usually counted as a member of the Graz School – was Christian von Ehrenfels (1859–1932), whose notion of 'Gestalt quality' is closely related to Meinong's concept of higher-order object.

Ontology, too, was conceived by the members of the school always from a scientific standpoint. Some – above all Vittorio Benussi – saw ontology as an empirical science. Others, however, like Meinong and Veber, saw ontology as a rational science (*GA*, VII, pp. 44f.). For Benussi it is empirical science alone which can show us how the world is made up. Thus Benussi hoped to penetrate through to reality in *experiments*, relating for example to the Müller–Lyer illusion, to illusions of apparent motion, or to the issue of the freedom of the will. Here all traces of rationalism have been abandoned in favour of 'experimental metaphysics' (see Benussi's article in the *Archiv für die gesamte Psychologie*, 37 (1918), p. 282).

Meinong's successor in Graz was Ernst Mally. Other Graz members of the school included Stephan Witasek, Rudolf Ameseder (1877–1937), Ernst Schwarz (1878–1938), and Wilhelm Frankl (1878–1933). Meinong's student France Veber represented the school in Slovenia, Vittorio Benussi in Italy, and Alois Höfler (1853–1922) and Johann Clemens Kreibig (1863–1917) constituted what might be regarded as a Viennese wing of the Meinongian movement. Hans Pichler (1882–1958) carried out historical investigations in a Meinongian spirit, for example in his *Christian Wolffs Ontologie* (1910).

Fritz Heider (1896–1988), Meinong's last doctoral student in Graz and author of an influential work on perception entitled "Thing and medium" (*Symposion*, 1927), was later closely involved with the Berlin Gestalt psychologists and acquired some distinction as an associate of Kurt Lewin (1890–1947) in America. Heider's 'psychology of interpersonal relations' remains of lasting importance.

Stephan Witasek was born in Vienna and received his doctorate from Meinong in Graz for a dissertation entitled *Investigations of the Theory of Complexity* (1895). His habilitation of three years later *On the Nature of the Geometrical-Optical Illusions* is a funda-

mental work of early perceptual psychology. Witasek published also *Principles of General Aesthetics* (1904), containing a hierarchical ontology of the different sorts of objects of aesthetic experience constructed from a Meinongian perspective.

Vittorio Benussi was born in Trieste and studied in Rome and Graz. His dissertation of 1901, under Meinong, is an experimental investigation of the Zöllner illusion. His habilitation (1904) deals with the perception of Gestalt structures and with illusions in the optical sphere. Benussi's work on perceptual presentations led to fundamental insights in regard to our experience of Gestalt structures which were important especially in prompting the critical reaction of Kurt Koffka (1886–1941). Benussi carried out early investigations also in the sphere of forensic psychology, especially on lie-detection via measurement of breathing symptoms. After World War I he was appointed professor for experimental psychology in Padua where he worked on the psychology of hypnosis and suggestion. His assistant, Cesare Ludovico Musatti (1897–1989), became an influential figure in Italy in his own right, both as a proponent of Freudian psychoanalysis and as a central figure in the Italian Gestalt tradition (see his *Condizioni dell'esperienza e fondazione della psicologia*, 1964).

Rudolf Ameseder was born in Serbia and grew up in Graz, where he studied philosophy and the history of art. His doctoral thesis under Meinong is entitled *On the Systematics of Ideal Objects* (1901). Ameseder's later contributions consist especially in systematic surveys of the Meinongian theories of objects and objectives and of the corresponding types of presentation.

Ernst Schwarz was born in Slovenia. His dissertation (1903) is entitled *On Phantasy Feelings*. In 1925 and 1934 he published two 'Meinong studies' entitled *Contributions to the Theory of Intellectual Phantasy* and *On Value, Oughtness and Correct Evaluation*. The latter contains valuable contributions to the theory of value in the spirit of Meinong.

William M. Frankl was born in Graz where he studied philosophy and classical philology, working especially on the theory of the economy of thought and on the idea of a foundation for logic in the theory of objects.

Psychology: Presentation and Gestalt. The Graz School distinguished four classes of mental experiences: two basic intellectual elements of presentation and thought, and two basic emotional elements of feeling and desire. All experiences are founded in (which is to say they depend for their existence on) underlying presentations (*Vorstellungen*). To each of the four basic elements there corresponds an object, a content, and an act. Content and act are here something mental, while the object is something extramental. Witasek defines the content of a presentation as "that part of the make-up of a presentation in virtue of which it brings a determinate object to consciousness". The relation between presentation and object is defined in terms of the idea of *Treffen* or contact (hitting a target).

The Graz School distinguished, as we have seen, objects of different levels; thus between objects of lower order (e.g. individual tones) and objects of higher order founded thereon (e.g. a melody). This corresponds to a relation of foundation on the side of the contents also (between founding contents – the individual tone-sensations – and founded contents – the presentation of the melody as a whole). Where content and object are in conformity one speaks of "adequate presentation". This does not, however, always obtain. Thus for example in the case of the optical illusions (consider, again, the Müller–Lyer figure) object and content fall apart, leading to what Benussi termed "presentational inadequacy". This, be it noted, is to be distinguished from inadequacy of judgement and belief, since in the Müller–Lyer case one can perfectly well *know*, intellectually, that the two horizontal lines are of equal length, and yet still fail to *see* them as such.

The simplest non-compound presentations are sensations. These are directed towards an independent object and are functions of the relevant sense organs. All other presentational contents are created on the basis of the contents of such sensory acts via 'acts of production' (*Vorstellungsproduktion*). Produced presentations (which is to say all presentations other than elementary sensations) correspond always to objects of higher order.

Three types of production process can be distinguished, corresponding to three distinct classes of objects – comparisons, relations (*Verbindungen*) and *Gestalten*: it is the latter which constitute the most important field of research of the Graz psychologists. Only recently have the psychological underpinnings of the philosophy of the Graz School been subjected to more detailed investigation. Work on the Meinongian theories of non-existence and on associated logical and semantic issues has however blossomed independently.

See also: **Logic V.**

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BARRY SMITH

Melanchthon, Philipp

Philipp Melanchthon was born in 1497 in Bretten and died in 1560 in Wittenberg. He was the founder of a school which had a strong impact on the development of 16th- and 17th-century Protestant scholasticism in Germany. Metaphysics does not occur as a discipline in the system of this school, for while its philosophy is bound to Aristotle, it is Aristotle seen through the eyes of Cicero (106–43 BC). Melanchthon begins his teaching in philosophy with a humanistic, anti-Aristotelian attitude, without metaphysics. After 1525, he turns to Aristotelian philosophy, which for him consists mainly in logic and ethics.

Logic itself is understood by Melanchthon as an inborn ability to recognize the order of things. Its task is to grasp the genera of the things which make the subject matters of the different sciences. Logic therefore deals not only with words, but has value in reality.

The categories, for Melanchthon, are first and foremost orders of words, but they comprehend also all things (*res*) and the Aristotelian system of categories forms "a small table of the universe of things" (*Erotemata Dialectices*, 1547). For Aristotle as for Melanchthon secondary substance does not exist independent from primary substance. Thus the world is for Melanchthon a universe of individuals. Substance is that *ens* which has its own being and is not a part of any other, a definition that is valid for God also.

Things are classified into substances and accidents. These highest categories are transcended by the word '*ens*' (*De dialectica*, 1536), which is in its nature the first and the last term in the inventory of things. It transcends all genera and species.

Melanchthon's pupil Owenus Gunther (Günther) (1532–1615), in his work *Methodorum tractatus duo* (1586) calls for a new discipline which would provide the common principles of all sciences. This discipline can be called 'wisdom' (*sapientia*). According to Gunther, Aristotle called it 'metaphysics'. It is "the common and royal discipline . . . of principles and things". Its task is to deal with the first principles, but also with things in general. Whereas logic deals with the principles, using them in demonstration, the *sapientia* considers them absolutely as beings. Metaphysics, therefore, in Gunther's view, differs from logic just as the cognition of simple ideas differs from an instrumental, application-oriented methodology of sciences. Gunther's claim for a new discipline of principles and things, apart from logic, opens the door to the reintroduction of metaphysics into the German Protestant schools in the period around 1600.

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Mendelssohn, Moses

Moses Mendelssohn was born in 1729 in Dessau (Germany). In 1734 he began his studies of the Talmud. In 1743 he moved to Berlin, where he became for a time the acknowledged leader of the German philosophy of the Enlightenment. Mendelssohn died in 1786.

Mendelssohn's fame in the 18th century as the 'German Socrates' depended above all on his *Phädon*, a modern adaptation of Plato's *Phaedo*, and like its predecessor a dialogue on the immortality of the soul.

We consider here three other writings, namely *Über die Wahrscheinlichkeit* (On Probability), 1756, *Abhandlung über die Evidenz* (Treatise on Evidence), 1763, and *Morgenstunden* (Morning Hours), 1785.

In the *Abhandlung über die Evidenz* Mendelssohn defends the idea of a parallelism between mathematics and philosophy. The former he sees as the science of quantity (including infinitesimal quantity); the latter as the science of quality – quantity and quality in the things being inextricably bound together. Philosophy has, like mathematics, a purely theoretical part which is independent of any applications: the subject of this science is the exact analysis of concepts, independently of the problem of existence. The concepts with which it deals are not concepts of existing substances, but metaphysical concepts like possibility, justice, the attributes of God, and so on. What results is less a Wolffian metaphysics than a kind of 'elements of philosophy' or *initia scientiae generalis* along Leibnizian lines. But for Mendelssohn such a science is more a task than a *datum*. This is because:

1. It is difficult to resolve concepts into simple elements because each is connected with many others;
2. for metaphysics we do not have a system of essential signs (*wesentliche Zeichen*) comparable to that of mathematics.

These problems are faced by Leibniz's *characteristica universalis*, also. Thus while metaphysics is as certain as mathematics, it is less intelligible or capable of being grasped by man.

The problem of the applied part of philosophy is the passage from the pure theoretical level to actuality. In applied philosophy certainty is lost, since every actual substance involves an infinity of causes and effects. Here we must employ the imperfect method of induction and, as its formal instrument, the calculus of probabilities, the subject of Mendelssohn's work *Über die Wahrscheinlichkeit*.

Here we have to develop syllogisms which, although formally equivalent to those of theoretical science, have only probable premisses. For we have not all the determinations of the subject which are necessary to attribute an indubitable predicate to it (cf. Wolff, *Logica*, 1728, §578). With the reiteration of experiences we approach mathematical certainty more and more; accordingly there is no sharp break, but rather a continuous passage between the theoretical part of the sciences (mathematics and metaphysics) and the experimental one (physics, applied ethics, politics, and so on).

The limit of absolute certainty is the science of God, a science which contains perfect knowledge of actual substances, of all the possible alternatives to these and to their *modi*, and which contains complete metaphysics.

These ideas are developed further in Mendelssohn's last work, *Morgenstunden*. The central point of the book, however, is quite different: it is the problem of the existence of God and of the world. Here many pages are devoted to the confutation of the idealism which "denies the existence of the actual world and the existence of bodies" (Wolff, *Psychologia Rationalis*, 1734, §36). To this purpose Mendelssohn builds a theory of actuality which is a development of the metaphysical principles of Alexander Baumgarten (1714–62). God thinks eternally all possible contingent beings. Every being is to be understood here as *essence with attributes*. Mendelssohn never speaks clearly of essence, though already in *Über die Evidenz* he presupposes it. God now attributes to every being all non-essential predicates which are compossible with it. Since each being is contingent, both any compossible predicate and its opposite are possible (*A* is *B* is as possible as *A* is not-*B*): at this level the thing

is still *indeterminate*. Now, however, God determines it by choosing one of two opposite predicates: and this is the actuality of a being, the complex of all its internal determinations (cf. Baumgarten, *Metaphysica*, 1779, §§39–40, 50, 55).

God's choice here changes nothing in the predicates themselves (they are eternal). Its reasons lie not in God's knowledge but in his approval (*Billigung*) of the goodness of the thing. God chooses the relative best connection of predicates in that connection of things which he chooses as the best among all others; and this is a state of the *actual world*.

Mendelssohn's definition of existence as 'reciprocal action' points also in this direction. In this way Mendelssohn finds an indissoluble bond between the science of the possibles, the existence of the world, and the existence of God. Thus it is possible for him to develop a proof of God's existence which involves elements of the cosmological (which takes existing things as starting-point), the teleological (every being exists and is determinate, thanks to God's approval), and the ontological arguments (the existence-predicate of finite things is contingent, and that of God is necessary). The *Morgenstunden* includes also one further proof which begins with the incomplete self-knowledge of human beings and with the necessity that God thinks every actuality.

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Merleau-Ponty, Maurice

Maurice Merleau-Ponty was born in 1908 in Rochefort sur Mer, and died in Paris in 1961. He was professor of philosophy in Lyon and at the Sorbonne from 1945 to 1952, and at the Collège de France until his death. Two related lines of thought are prominent in Merleau-Ponty's philosophical work. The first (which he owes in part to the tradition of 19th-century French spiritualism) is the idea that, if ontology is to be possible at all, then it should reject the classical dualisms of man and world, freedom and nature, mind and body, matter and form, object and subject, and that it should attempt to explore a region that lies 'in between' the various terms of these oppositions. The second (which is adapted from Edmund Husserl's notion of *Lebenswelt*) is that scientific truth and objectivity are ultimately based upon an unreflective experience of the world which is the very condition of meaning and truth.

Both themes are present in Merleau-Ponty's *The Structure of Behaviour* (first published 1942). The first part of this book is an analysis and criticism of behaviourist psychology. The second builds upon this criticism a theory of the relationships of nature and consciousness. Using the work of the Gestalt theorists, Merleau-Ponty shows that behaviour cannot be reduced to the physical relationship between stimulus and response, and cannot be divided into atomic parts, but is made of totalities or structures which are irreducibly intentional responses to a meaningful 'situation'. However, Merleau-Ponty criticizes the psychologists' notion of Gestalt. Forms and structures are, he argues, not physical; they belong *both* to the world of consciousness and to the physical world. In this sense, there is no discontinuity between body and mind. Nature is a 'universe of forms' arranged continuously according to a hierarchical order, from the inert world of matter to the living world and the world of man. This construction, although explicitly inspired by Kurt Goldstein (1878–1965), is nevertheless closer to Emile Boutroux (1845–1921) (*De la contingence des lois de la nature*, 1874) than to Kurt Koffka (1886–1941) or Wolfgang Köhler (1887–1967).

Merleau-Ponty's notion of form secures the transition between nature and consciousness. All forms have their origins in perception. The main task of Merleau-Ponty's *Phenomenology of Perception* (1945) was to

establish the primacy of the philosophy of perception over the other branches of philosophy. Against the Cartesian idealist and intellectualist traditions, according to which all perceptual contents are the products of conceptualized judgements, this 'existential phenomenology' seeks to show that the perceived contents are independent of judgement, and that a tacit experience of things conditions all our beliefs. This completes Merleau-Ponty's reflections on the mind–body problem: the *cogito* is to the *percipio* what the mind is to the body, and the link between them is assured by the 'phenomenal body' (*corps propre*), which is distinct from the 'objective body', the latter being only a derivative construction which owes its existence to the former. The phenomenal body is the projection of our primitive experience of spatial and temporal relations. It is the transcendental condition of spatiality and temporality. The question arises whether Merleau-Ponty's attempt to escape the alternatives between body and mind and between realism and idealism as concerns the external world, does in fact succeed. The thesis that the objective body depends for its existence upon the phenomenal body can itself be seen as a form of idealism (Baldwin 1988).

Merleau-Ponty's later work continues his analysis of the embodiment of thought and language through a philosophy of expression and symbolism. In conformity with his previous interpretation of the psychologist's Gestalten, he is led to consider the structures of the structuralist linguists and anthropologists as living forms, which are neither objective nor subjective, and are both outside us in natural and social systems and inside us as symbolic functions. Phenomenology in Merleau-Ponty's sense is the description, always incomplete and unfinished, of the birth of meaning in language and in experience.

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Metacosmology

Metacosmology is the meta-theoretic examination of philosophical cosmologies. It comprises three general approaches: typology, analysis of the nature and structure of cosmologies, and meta-theoretic comparison and evaluation. To some extent this sequence of approaches reflects the historical development of metacosmological thought.

Most metacosmologists have taken cosmology to be primary in the sense that the structure of the universe determines the nature and structure of all else, including other theories. For this reason, cosmology is often equated with metaphysics.

Structure and Evaluation. According to the *root-metaphor theory* of Stephen C. Pepper (1891–1972), cosmology is a hypothesis, which in turn is a metaphor or analogy of the form 'x is like y'. A cosmological system is the same as a scientific hypothesis except that its scope is totally unrestricted. Thus, x may be instantiated by anything or everything. The *world-hypothesis* is defined by the instantiation of y. Mechanism, e.g., is the hypothesis that 'the world (x) is like a machine (y)'. The root-metaphor implies the categories of the system. A system resting on machine structure, for example, implies that location and substance are to be included among its categories.

Pepper's now classic *World Hypotheses* also presents a detailed consideration of meta-theoretic comparison, adequacy conditions, and inter-theoretic evaluation. His metacosmological theory employs three tests of the adequacy of a cosmology:

1. its scope should be unlimited;
2. it should be precise in the sense that it does not generate multiple explanations; and
3. it should enjoy purity of root-metaphor and hence display intra-theoretic coherence.

Any hypothesis of the structure of *all* reality will contain an epistemology, a logic, and an axiology. Hence, all concepts of evaluation and all interpretations of truth and 'adequacy' will presuppose some world-

hypothesis. Thus, Pepper concludes that no neutral meta-theoretic vantage can exist from which to rank the adequacy of world-hypotheses.

Everett W. Hall (1901–60) tried to resolve this conundrum (Hall's 'categorio-centric predicament') by seeking adequacy standards from what he called the 'extra-philosophical universe'. His meta-theoretic vantage and adequacy test are derived from the form (not the content) of common thought and speech.

Pepper's identification of the problem unique to meta-theoretic evaluation of metaphysical systems has made its greatest impact in the philosophy and history of science. Thomas Kuhn's close adaptation of his mentor's metaphilosophy to theory-change in science, *The Structure of Scientific Revolutions* (1970), fails to recognize that *scientific* paradigms need not include an epistemology, logic, and axiology. He thereby ignores the force of Pepper's thesis that it is unrestricted scope which blocks meta-theoretic evaluation.

Recent philosophers considering the nature of conceptual schemes have shared Pepper's, Hall's, and Kuhn's worry that meta-theoretic evaluation may be impossible. But Williamson (1983) argues that the unlimited scope which generates the unique meta-theoretic evaluation problems of meta-cosmological systems also assures that they cannot be incommensurable. Further, the system-bias of adequacy standards is non-problematic when the standards employed are common to all systems under consideration. The metacosmologist is not burdened with the requirement that he discover adequacy standards external to the systems being compared. Such standards must be neutral; but they need not be external.

Typology. Metacosmologies have been forthcoming especially in France and in the United States. In France, Charles Renouvier (1815–1903) maintained that philosophies represent irreconcilable viewpoints. Victor Cousin (1792–1867) saw philosophies as systems which contain unifying ideas. This led Cousin to the claim that all philosophies, leaving aside eclecticisms, are of four types, which he calls sensualism, scepticism, idealism, and mysticism.

In the United States, Josiah Royce (1855–1916) took metaphysics to be comprised of an ontology and an epistemology. He classified metaphysical systems according to their conception of being, in a way which led him to distinguish four types: realism, mysticism, critical rationalism, and (Royce's own) constructive idealism.

Edward Spaulding (1873–1940) classified metaphysical theories according to the theory of relations which they presuppose: the old internal theory of relations (of which there are two types, causation philosophies and substance philosophies), and Spaulding's own new theory of external relations. William Hocking (1873–1966) classifies philosophical systems according to their position along a spectrum which represents the degree to which they give priority to ontology versus epistemology. In *The Strife of Systems* (1918) William Sheldon (1898–1977) saw monistic idealism, pluralistic idealism, materialism, Thomism, process philosophy, and irrationalism as philosophical systems distinguished by their region of attention and motivation for belief. Finally, Stephen Pepper's investigations are the most explicitly metacosmological and the most influential in metaphilosophy. Pepper's root-metaphor theory reveals eight types of world-hypothesis: generating-substance theory, mysticism, animism, formism, mechanism, contextualism (pragmatism), organicism, and Pepper's own selectivism (a process philosophy).

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A. MARK WILLIAMSON

Metaontology

Metaontology can be defined as the theoretical enterprise whose primary goal is that of analysing and comparing ontologies.

Metaontology can be distinguished from ontology in that in the latter we attempt to articulate a theory of reality, while in the former we seek techniques of theoretical analysis which are applicable to all ontologies. A paradigmatic example of a metaontological issue is the theory of ontological commitment. When it is proposed, for example, that the entities to which a theory is committed are those objects over which the bound variables of the sentences of the theory must range (Quine 1961), this proposal is to be understood as applying to all theories.

A more detailed specification of the aims of metaontology can be provided by listing the components that a fully articulated metaontological theory would have:

1. a clear definition of an ontological framework,
2. a theory of ontological commitment,
3. an account of the notion of ontological dependence,
4. a theory of ontological reduction,
5. a semantic interpretation for sentences which compare ontologies, i.e., for sentences with variables that range over the domains of different ontologies,
6. a general method for dissecting and analysing the entities posited by any ontology, and
7. an account of the notions of ontological commensurability/incommensurability.

Notice the distinction between ontological dependence and ontological reduction. Ontological reduction deals with the question of how we can avoid commitment to entities of a certain type by showing that those entities can be eliminated in favour of entities of another type. The usual procedure is to show that we can systematically translate those true sentences in which reference is made to the suspect entities into sentences in which such references have disappeared. The issue of ontological dependence, on the other hand, deals with the articulation of the various relations of existential priority or basicness which can hold between the different types of entities to which a theory is ontologically committed. The relation between substances and attributes and the relation of supervenience between physical and mental attributes are examples of such relations of ontological dependence.

Even though the literature on ontological reduction is vast (Bonevac 1982), discussions on ontological dependence – with the exception of discussions of supervenience – are scarce (Simons 1987, Smith 1982). Despite this, the notion of ontological dependence is crucial for understanding the internal structure of many ontologies. The ontology of a theory cannot be understood simply as a domain of objects; for in many cases certain types of objects in that domain are existentially dependent on other, more basic types of objects. For example, we can hardly claim to have specified Plato's ontology by saying that it consists of Forms and physical objects. The relation of ontological dependence of physical objects on the Forms is of fundamental importance for understanding the structure of his ontology.

The concept of ontological dependence can also enable us to attain a fuller understanding of a theory's commitments: we can distinguish between the basic and the nonbasic commitments of a theory by specifying the types of entities which are ontologically dependent on other more basic types of entities within that same theory. Further, we can also recognize that two ontologies can be domain commensurable yet structurally incommensurable because their relations of ontological dependence differ.

Condition (5) could be fulfilled by developing a formal language with different quantifiers ranging over the domains of the ontologies being compared. This language would also include quantifiers which range over both of the domains, so that model-theoretic semantic rules could be formulated to interpret sentences with variables ranging over both ontologies.

Condition (6) involves an elucidation of the different principles of constitution and individuation which apply to the entities which are granted ontological status by different ontologists. Some philosophers believe, for example, that objects can be ontologically analysed as substances characterized by properties which can be instantiated at differ-

ent places and times, while others believe that objects should be construed as bundles or sets of properties connected by certain determinate spatio-temporal relationships. Our task here would be systematically to differentiate and elucidate the various conceptions of constitution, individuation, and predication used by different ontologists.

Condition (7) involves the specification of principles for determining when two or more ontologies are commensurable or incommensurable. The notion of the ontological or metaphysical commensurability of two or more theories could be understood by describing the restrictions which each of the respective theories place not only on the actual world but on possible worlds as well. The ontological commensurability of theories can then be construed in terms of the overlap or intersection of the sets of possible worlds which are compatible with the theories. The introduction of the notion of possible worlds into the analysis is important, because it allows us to capture the modal force that many ontological claims carry. Thus, a physicalist who believes that mental properties are ontologically supervenient on physical properties would maintain that any possible world which is compatible with his theory must be such that, if entities with mental properties exist, then those entities must also instantiate certain physical properties.

Notice also that we should distinguish between metaphysical and logical necessity, because our physicalist, for example, could very well maintain that a world with disembodied minds is logically possible but metaphysically impossible (from his perspective). At the formal level we could define a metaphysical necessity-operator that places restrictions on the broader set of logically possible worlds.

The importance of metaontology ultimately lies in its potential for clarifying the ontological enterprise. Unless we recognize explicitly that metaontological issues are different from ontological issues, we will not be entirely clear about what we are doing as ontologists. An adequate metaontological theory will provide us with a deeper understanding of the nature of ontology.

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JORGE M. VALADEZ

Metaphysics I: History and Terminology

At first, metaphysics seems to have been a heading under which early Aristotelians united fourteen treatises by their master; they placed them after the writings on physical realities. This placement as well as the title are due to Aristotle's division of knowledge: 'μετά meaning both 'after' and 'behind', the *Metaphysics* were treatises following those on 'physics' *because* they dealt with what is beyond the physical world.

The unity of these treatises, however, has puzzled scholars since antiquity. Aristotle claims that they contain a 'first philosophy', 'wisdom', and 'theology' and deal mainly with realities that are subsistent (or separate from matter) as well as immobile. This is a definition of what later came to be called 'immaterial entities'. However, Aristotle also claims that the subject matter of this part of philosophy is 'being as being' and he indicates that it also deals with the first premisses of knowledge.

Probably the only consistent interpretation was advanced by Aquinas. Objects of physics and mathematics are 'constituted' by acts of abstraction: the former disregards individual characteristics, the latter moreover considers only quantity. Metaphysics on the contrary presupposes an act of 'separation', i.e. a negative judgement to the effect that to be does not necessarily entail being corporeal. Under this premiss an observer whose scope of cognition is limited to what his senses offer tries to isolate those features of physical

realities that can be attributed to immaterial realities, and by inference construes whatever is to be said about the latter. Thus to consider being as being, means to consider material things with respect to what they have in common with immaterial realities – the latter being held to explain certain features of the material world both causally and through participation. Accordingly, metaphysics deals with whatever throws light on what is common to bodies and spirits as well as on their interrelation.

Pursuing mainly what today would be called empirical research, Aristotle's pupils seem to have been little interested in metaphysics; for centuries it became a privilege of (neo-)Platonists, who of course took up many of Aristotle's ideas and notions. In most cases, they understood metaphysics as an approach to the divine and therefore discussed it as 'epoptics' (the initiation to a vision of the Absolute) or 'dialectics' (the knowledge of definitions and distinctions immediately preceding such vision). This is also true of most premedieval Christian philosophers: although they raised many metaphysical issues of the Aristotelian kind and although Christian theologians from the time of the Alexandrian Fathers used metaphysical notions to articulate their faith, metaphysics was seen almost exclusively as a 'wisdom' leading to a knowledge of God.

The first truly to understand what Aristotle had in mind was Alexander of Aphrodisias (fl. 2nd/3rd century AD), who wrote a commentary on the first five treatises (the other treatises are written by an 11th-century Byzantine scholar). Although more naturalistic than Aristotle, he concentrated on what the latter described as 'the eternal question', namely what being primarily amounts to. His reply to the question is thoroughly Aristotelian: it is 'substance', i.e. a concrete subsistent essence; a being in the primary sense is an individual or individualized form that actually exists.

The next step in the development of metaphysics we owe to the intermediary of the Arabs, above all to Avicenna (Ibn Sina) (980–1037), who throughout the Middle Ages was called 'the Commentator'. Dwelling on the difference between what cannot be other than it is (the necessary) and what is but might not be or might be different (the contingent), he was the first to apply Aristotle's philosophy of science (the *Posterior Analytics*) to metaphysics. As a result he argued that the subject of metaphysics is being, while God is considered as the cause explaining its characteristics. This claim is a development of what Aristotle had meant which takes account of the idea of creation; because Aristotle had no inkling of creation, his God only explained motion and therefore, though he was the most perfect of all beings, could not be viewed as a cause of being.

The Arab approach was further developed by medieval theologians, and above all by Thomas Aquinas, whose metaphysics centred around the notion of *esse* (the act of being). While claiming that God is pure actuality, Aristotle had not connected this idea with the notion of the existence of other beings; the latter was implicit in what he called 'act' (ἐνέργεια). Aquinas, on the contrary, noticing that something is called a being because it exists, described being-an-actual-reality as a sharing in the 'to-be-itself (*ipsum esse*)' that had created it. A being is a 'to-be' that is either subsistent and therefore unlimited or shared by an essence that limits it. In addition, Aquinas emphasized that to grasp something by the intellect amounts to grasping it as a being. The intellect implicitly reaches both the first principles of knowledge and the first causes of being. Metaphysics is the explication of these principles. God, however, may be reached only as a cause (*a posteriori*); Aquinas rejects the ontological argument.

Aristotle and Aquinas argued that 'being' is a systematically ambiguous (analogous) term; in Aquinas this amounts to saying that the *esse* which God is and all other beings share is something different in each being. Though Aquinas's '*esse*' means more than 'existence', namely perfection, this claim is virtually unintelligible when applied to the former. Therefore, one generation after Aquinas, John Duns Scotus insisted that there must be a basic meaning of 'being' which remains the same through all uses of the term. A being then is that which has an

essence. This line of thought no longer insists either on substance or on *esse* and leads to a prominence of what is conceptually possible, which remains a characteristic of metaphysics down to Leibniz; metaphysics and (material) logic move closer to each other.

The first full treatment of metaphysics which was no longer a commentary on Aristotle, the *Disputationes Metaphysicae* of Francisco Suárez (1597), tries to return to Aquinas's position. Yet as even leading Thomists such as Cajetan (Thomas de Vio) and John of St. Thomas (John Poinsot) did not fully grasp Aquinas's doctrine of *esse*, Suárez succumbed to Scotus's 'univocity of being'. In spite of his subtle analysis of analogy, Suárez tends to reduce a being on the one hand to an essence, on the other hand to its merely existing. Between the followers of Thomas Aquinas (Dominicans), John Duns Scotus (Franciscans), and Francisco Suárez (Jesuits) quarrels long continued; usually they centred around minor points (the distinction between essence and existence, matter as potentiality, the nature of relations) and the opponents misunderstood the context of each other's claims. Metaphysical arguments tended to become vacuous exercises in logical subtlety.

The fact that metaphysics moved steadily closer to logic is in part due to Aristotle himself. He still lacked the terminology to distinguish between natures and definitions, essence and concepts, and discussed some topics (e.g. categories) both in the *Organon* and in the *Metaphysics*. Probably more important, however, is the fading into insignificance of teleological thought. Though in different ways, Aristotle and Aquinas attached great importance to *final causality*; therefore, they placed in the foreground notions such as 'substance' and '*esse*' that lent themselves to a dynamic analysis. As teleology became less important, philosophers emphasized essences and thereby drew attention to issues which are ultimately purely conceptual, indeed problems of logic.

This trend is clearly visible in most thinkers of the 17th and 18th centuries who did not reject metaphysics outright as an empty play with words. Metaphysics begins to fall apart into a discipline discussing the most general concepts (*metaphysica generalis, ontosophia, ontologia*) and 'natural theology' (*metaphysica specialis*). Thus metaphysics enters modern times on the one hand discredited and on the other hand with clipped wings.

However, as the ideas of both antiquity and Christianity began to loosen their hold on people's minds (and esoteric doctrines of gnostic and cabbalistic origin became prominent), there also emerged completely new types of metaphysics. Often, they were launched under a different name; an example is Spinoza's *Ethics* which also had a tremendous impact on German philosophy. The most fundamental difference between the old and this new kind of metaphysics is that the former was mainly concerned with 'saving the phenomena', i.e. explaining puzzles of experience, while the latter largely ignored the way we experience reality. Spinoza's pantheism fails almost completely to take account of the fact that to a very large extent we experience the world as consisting of individuals; Leibniz's monads do not correspond to what we think we experience as individuals. Moreover, logic and mathematics became a pattern of thought to which both the method and the content of metaphysics had to adjust. As a consequence, whenever it did not continue along traditional lines, metaphysics tended to become highly speculative. It is to Kant's credit that he saw through this; in a strange way, he understood better than most of his modern predecessors what metaphysics originally intended, namely to analyse and extrapolate from our experience in such a way that we might be able to say something about realities of which we have no experience. Moreover, he realized that this can work only if our conceptual analysis of objects of experience penetrates to their innermost nature and applies to the latter principles of inference that ultimately stem from reality, not from our way of thinking. As Kant, for various reasons, felt impelled to deny that our insight can reach what the objects of experience are 'in themselves', he dismissed metaphysics as a phantom, despite admitting that the pursuit of it stems from a natural human inclination. Curiously enough, it was a late work by Kant, the *Critique of Judgement*, which in German

idealism, in particular in Hegel, led to a thoroughly new kind of metaphysics, which, though it may be considered its definitive perversion, is in many aspects reminiscent of what thinkers such as Aristotle or Aquinas intended: not only an account of what is both essential and common to everything that is, but also a theology.

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NICHOLAS LOBKOWICZ

Metaphysics II: Greek Metaphysics

There is a tradition of metaphysical thinking, running from Parmenides (fl. 5th cent. BC) to Plotinus (*c.* 205–70) and beyond, according to which, at the highest level, the thinkable and the real are identical, thinking and being both exhibiting to the highest degree the qualities of unity and stability. We shall here look at four of the major contributors to this tradition: Parmenides, Plato, Aristotle, and Plotinus.

Parmenides. Parmenides stands apart from his cosmologist predecessors in three important ways:

1. Whereas their method had been to advance quasi-scientific hypotheses, Parmenides proposed a method of deducing philosophical theses from *a priori* principles.
2. Whereas they had speculated about the material constitution of reality, he sought to articulate the formal features of being.
3. His speculations were second order, not simply thought about reality, but also thought about thought about reality. Parmenides was attempting to map out – perhaps to blaze – a rigorous philosophical trail along which enquiry about the real might be pursued.

Among Parmenides's predecessors as a metaphysician, two names stand out. Pythagoras and his followers saw ordinary things as approximations to a mathematically determined basic reality. Heraclitus contrasted the contradictory flux of appearances with a hidden stable order. Yet, the Pythagoreans and Heraclitus, just as much as the early cosmologists, lacked Parmenides' rationalism and formalism, and they were not second-order thinkers. It was in Parmenides that the metaphysical tradition achieved its first full flowering.

One of the *a priori* principles upon which Parmenides based his metaphysics was the principle of non-contradiction: "For never will this be proved, that things that are not are". At the same time, Parmenides recognized that the thought of those whom he calls 'ordinary mortals' included many contradictions. He characterized these ordinary mortals:

> By whom being and not-being have been thought both the same
> And not the same

as 'two-headed' and 'uncritical'. He dismissed much of their language as 'mere names', thus making it clear that his point of

view rejected ordinary standards of thought.

The principle of non-contradiction expresses a thought about thinking as well as a thought about being. The kind of thinking which it governs is the kind of thinking in which things are 'proved'. It says that there are no contradictions either in reality or in the kind of thinking where proof is found. A further correspondence between being and thinking was postulated by Parmenides when he laid down what we may call Parmenides's principle: "The same thing is both for thinking and for being". It is no objection to Parmenides's principle to say, as the Sophist Gorgias (*c.* 485–380 BC) did, that non-beings such as the Chimera are thinkable. For, it is clear that the thinkable, in Parmenides's sense, does not include much of what ordinary mortals claim to think. Parmenides's principle was stated in a context where the thought and language of ordinary mortals are opposed to fate. Parmenides says, about what is, that:

> Fate fettered it to be entire and immovable. Wherefore all these are mere names which mortals laid down believing them to be true – coming into being and perishing, being and not being, change of place and variation of bright colour.

It is clear that the opinions of mortals, as outlined by Parmenides, conflict with his principle, just as they conflict with the principle of non-contradiction. "There is no truth", he wrote, in those ordinary opinions.

The thinking referred to in Parmenides's principle is of a kind that did not exist before him, a kind of thought in which enquiry after truth is pursued, a kind of thought whose language he was trying to forge. What his principle says is that in that kind of thought there are truths, and that all such truths are of what is.

Parmenides's principle excludes two things – thoughts which are not of a being, and beings of which nothing can be thought. The latter exclusion marks an anti-mystical streak in Parmenides which should be noted by those who see in him a great mystical theologian.

Parmenides expressed the central thesis of his metaphysics in the single Greek word ἐστίν: it is. This thesis is established by an eliminative argument. There are, thinks Parmenides, only two possible ways along which enquiry could be pursued:

> one, both that it is and that it is not for not being,
> is the path of Persuasion (for truth accompanies it)
> the other, both that it is not and that it is necessary
> for it not to be
> – *that*, I tell you, is a track beyond all tidings.
> For neither would you recognize that which is not
> (for it is not accomplishable),
> nor mention it.

The true way can be interpreted as saying that there is no non-being. This is not a trivial claim. In languages where there are two sets of quantifiers, one of the particular (existential) quantifiers might be tied to beings and the other not. In such ontologies it will be true that there is a non-being.

Parmenides's argument can be seen as resting on Parmenides's principle. If not everything is, then something is such that *it is not*. Hence (taking 'it is not' to be a thought of *it*) it is. Thus Parmenides's principle implies that everything is: being is pervasive.

According to Parmenides, being is not only pervasive but also necessary. He identifies what is with what must be, and what is not with what cannot be: what can be is, and what is not cannot be.

This necessity of being (i.e. the proposition that every possible being is a being) is implied by Parmenides's principle (that every subject of thought is a being), along with the proposition (which Parmenides also accepted) that every possible being is a subject of thought. Alternatively one can derive the two halves of Parmenides's principle from the necessity of being, along with other Parmenidean theses. The interderivability of these theses may have been what Parmenides meant when he wrote:

> It is indifferent to me
> whence I begin; for I shall come back there
> again.

In fact, Parmenides asserted the coextensiveness of the three classes: possible beings, beings, and subjects of true predications.

Parmenidean metaphysics will not tolerate anything whose thought implies the being of what in any way is not. Thus, past and future are not possible objects of enquiry; neither is

coming-into-being or passing away, or any change. Thought of these things is thought of nothing, and thus, strictly speaking, no thought at all. The names are among the mere names which mortals have laid down believing them to be true.

Plato. Plato's attitude to Parmenides was ambivalent. Though he paid him the compliment of making him the principal character in one dialogue (the *Parmenides*), in that and an adjacent one he subjected many of Parmenides's ideas to a searching examination. In particular, the contrapositive of Parmenides's principle is stated at *Sophist* 238c:

> STRANGER: One cannot legitimately utter the words, or speak or think of that which just simply is not; it is unthinkable, not to be spoken of or uttered or expressed.

In this form, the principle is taken to undermine itself, since it itself is a thought about what is not.

Plato himself states a version of Parmenides's principle which is not open to the charge of self-refutation. This is the principle that what is can be attributed only to beings: If *a* is *b*, and *b* is, then *a* is (*Sophist* 238a). Plato's version of the principle is weaker than that of Parmenides. It does not imply the pervasiveness of being. Consistently with it, one can suppose that something is not. Let that thing be *a*. Then '*a* is *a*' does not of itself imply '*a* is' by Plato's principle.

Plato's own weaker statement of Parmenides's principle is assumed by him as a true premiss with which to combat Parmenides's statement of the principle of non-contradiction. The argument is that, since number is, it cannot be attributed to what is not (*Sophist* 238a–b). The point is that in Parmenides's statement of the principle of non-contradiction, 'things that are not' are spoken of in the plural, thus attributing number to what is not.

Plato stated the principle of non-contradiction in this form:

> SOCRATES: The same thing clearly cannot act or be acted upon in the same part or in relation to the same thing at the same time, in contrary ways (*Republic* IV, 436b).

Apparent counterexamples are explained away along the lines of the man who is moving and not moving because one part of him moves and another does not. The tactic proposed is to save the principle by finding two different subjects to which the incompatible predicates can be ascribed.

Elsewhere, and perhaps under the influence of Heraclitus, Plato seems to have challenged the principle of non-contradiction and to have used its supposed lack of universal validity as an argument for the existence of a realm of being which is not subject to the principle. *Republic* VII seems to suggest that the world of sensible appearances is a world where contradictions abound. The sense "intimates to the soul that the same thing is felt to be both hard and soft" (524a). According to the 'intimations of the senses', the hard is soft, the one many, and so on. These contradictions are perplexing, and 'draw the soul towards being' (523a):

> SOCRATES: When there is some contradiction always present, and one is the reverse of one and involves the conception of plurality, then thought begins to be aroused within us, and the soul perplexed and wanting to arrive at a decision asks 'What is absolute unity?' This is the way in which the study of the one has a power of drawing and converting the mind to the contemplation of true being (524e–525a).

It is the existence of contradictions in the world of becoming that "turns the soul around" (521c), enabling it to "rise out of the sea of change and lay hold of true being" (525b). Thus, beings in the highest sense obey the principle of non-contradiction; and even though sensible beings may not be subject to it, that very fact is what leads the mind away from the contradictory world of sensible particulars to the postulation of intelligible beings that are free of contradiction. The intellect could not be satisfied by a kind of thinking in which contradictions occur, but must advance beyond contradictions to a kind of thinking (Plato calls it knowledge) which is freed of contradictions. Knowledge, for Plato, is a dynamic concept: it is to be *attained*. It and its objects are objects of *desire*.

This doctrine undergoes a development in some of the late dialogues where Plato points out that it is not only sensible particulars but also the Forms themselves that are subject to

contrary predications. In the *Sophist*, intelligible beings are shown to be just as much subject to contrary predications as are sensible particulars. For instance, being itself, just as much as any sensible particular, is both the same and different (255d). Again, when in the *Parmenides* Socrates says he would be amazed if one of the Forms turned out to be subject to contrary predicates (129c), Parmenides shows that precisely this is the case. The One turns out to be both one and many. Maybe such examples can be explained away as not genuinely conflicting with the principle of non-contradiction: the One is one and many in relation to different things. Even so, they do conflict with the assumption defended in the *Republic* that intelligible beings differ from sensible particulars by not being subject to contrary predicates.

In the *Sophist*, Parmenides's statement of the principle of non-contradiction is subjected to "a mild degree of torture" (237b). The attack on Parmenides is made vivid by the Eleatic Stranger's description of himself as "a sort of parricide" (241d) against Father Parmenides. Plato represents Theaetetus as happily using the name "what is not" (258b), even though he had earlier agreed with the Eleatic Stranger's absolute prohibition on mentioning or even contemplating what is not. In this new sense, what is not is said by the Stranger to be (258b–c), and Theaetetus agrees. What is not is said to be because change both is and is not. Change is, because it is something (for instance, itself); and change is not, because it is not something (for instance, it is not being).

STRANGER: There is much that each Form is, but an infinite number of things that it is not (256e).

But not-to-be, in this sense, is not the same as not to-be. Accordingly, though Plato makes out that he is disagreeing with Parmenides's statement of the principle of non-contradiction, he is not in fact doing so. Being is not incompatible with not-being: indeed, if there are at least two beings, then every being is also a not-being, and vice versa (258e).

Plato's motive for constructing this new sense of not-being has to do, not so much with the principle of non-contradiction, as with the problem of false statements. The problem of false statements is that, according to Greek usage, to say what is false is to say what is not. And to say what is not is the same as not saying anything, i.e. not speaking. So it seems that to say what is false is the same as not to speak. Plato's suggestion is that this problem can be solved by using his new concept of not-being. The idea is that Theaetetus for example is a not-being because Theaetetus is not flying. In other words, what makes it false to say 'Theaetetus flies', namely Theaetetus's not flying, is indeed a kind of non-being, namely Platonic not-being. But, precisely because not-being is construed analogously to the way being is construed, it is clear that one was wrong to suppose that saying what is false is not saying anything. In fact it is to say that something partakes of not-being, just as we might say that something partakes of being.

Though entirely in agreement with the fundamental idea that what is most real is most intelligible, Plato's metaphysics introduces two distinct innovations to the Parmenidean system: Plato abandons Parmenides's thesis of the homogeneity of being in favour of an ontology which comprises two classes of beings; and he introduces for the first time abstract beings into metaphysics.

The two classes of beings in Plato stand in an ordered relation to one another. Let us call beings in the primary class beings*. Derivative kinds of beings then stand to beings* in some relation, such that for them to be is for them to be thus related to a being*. Let us call such a relation a relation of ontological dependence, and designate the class of such relations by the letter R.

Plato's belief in abstract beings (the Forms) arises from his belief that corresponding to each member 'a' of some class N of names, there is a name 'a^*', such that all the things that are a are so by virtue of standing in a relation μ to what is a^*. What is ordinarily called beautiful is so only by standing in the relation μ to what-is-beautiful*. The latter (the Form of the beautiful) is what is beautiful in the highest and purest sense. It is what is *really beautiful*.

What-is stands in a relation R of depend-

ence to what-is*. But what-is also stands in relation μ to what-is*. Thus for Plato μ is a member of the class *R* of relations of ontological dependence. Not only is the Form of the beautiful *really beautiful*; it *really is*.

Plato will not be forced into an unambiguous statement about the identity of μ. In one dialogue (the *Phaedo*) he tries 'approximates' (74d), 'imitates' (74e), 'strives after' (75a), and 'desires to be like' (75b) as names for the relation. Nor is he perfectly clear about the membership of *N*. Among its members are 'good', 'courageous', 'one', 'being', and 'not-being'. At *Parmenides* 130d, Socrates is definite in his rejection of Forms for mud, hair, and dirt, on the grounds that these are 'trivial and undignified' things. But he is unsure whether there are Forms for substances such as Man, water, and fire.

The three salient features of Plato's theory of Forms are:

(1) that sensible particulars are named *eponymously* after the Forms,

(2) that Forms are *individuals*,

and

(3) that Forms are *separate* from sensible particulars.

Ad (1) Things are *named after* the forms:

PHAEDO: It was agreed that each of the forms was something, and that the other things, partaking in them, took the name of the forms themselves (*Phaedo* 102b).

This is not just a matter of the same name applying to what is beautiful and what is beautiful*. What is beautiful is so *by virtue of* standing in the relation μ to the beautiful*.

Ad (2) Each Form *a** is an individual, albeit an intelligible rather than a sensible individual. For instance, in the Third Man argument, a Form is taken as one thing alongside the particulars that participate in it:

PARMENIDES: But now take largeness itself and the other things which are large. Suppose you look at all these in the same way in your mind's eye, will not yet another unity make its appearance – a largeness by virtue of which they all appear large? SOCRATES: So it would seem (*Parmenides* 132a–b).

Parmenides's supposition, of course, leads to trouble; but Plato did not think that this was because what-is-large* was taken to be an individual.

Ad (3) That which is *a**, if there is such a being, exists "itself by itself" (αὐτό καθ' αὐτό: 128e–129a) and 'separately' (*choris*: 130b). It does not exist in the things that are *a*, but separately from them. This implies that for it to exist it need not have instances. Consequently, there is no reason why it should not exist eternally.

Aristotle. Aristotle stated the principle of non-contradiction thus:

For the same thing to belong and not to belong to the same thing and in the same respect is impossible (given any further specifications which might be added against the dialectical difficulties) (*Met.* 1005b19–20).

He here borrows the language of 'belonging' and 'not belonging' from his syllogistic, in an attempt to give this principle a rigorous formal statement. At the same time, his concern to deflect all possible objections results in a certain loss of precision.

The firmest of all principles, Aristotle believed, would be one regarding which error was impossible:

for such a principle must be both the best known (for all men may be mistaken about things which they do not know), and non-hypothetical. For a principle which everyone must have who understands anything that is, is not a hypothesis; and that which every one must know who knows anything, he must already have when he comes to a special study (*Met.* 1005b13–17).

That the principle of non-contradiction has this status (and thus that contradictions are literally unthinkable) Aristotle showed as follows:

if it is not possible for contraries to belong to the same thing simultaneously . . . and the opinion contrary to an opinion is that of the contradictory, then obviously it is impossible for the same person to believe simultaneously that the same thing is and is not (*Met.* 1005b26–30).

Aristotle did not think that, by arguing that the principle of non-contradiction has this status, he had demonstrated its truth. On the contrary, he knew that its truth had been assumed in that argument. Not everything,

he said, can be demonstrated; and if there are indemonstrables, this principle is among them (*Met.* 1006a10–11).

However, Aristotle thought that anyone who says anything at all must "signify something" (1006a20), and anyone who signifies something is committed to the principle:

> It is therefore necessary if it is true of anything to say that it is a man, that it be a biped animal (for that was what 'man' signified); and if that is necessary it is not possible that the same thing should not be, at the same time, a biped animal . . . Therefore it is not possible that it should be simultaneously true to say that the same thing is a man and is not a man (*Met.* 1006b28–34).

In his logical writings, Aristotle adopted a restricted version of Parmenides's principle. He does not claim that every predication implies that its subject is a being. This implication is said to hold only in those cases where what he calls a 'verb' is predicated, it being part of the definition of a verb that it lacks complexity (*De Int.* 16b5).

It was part of his position that Parmenides's principle does not hold for any denial. For no denial predicates a verb of a subject. At 16b11–15 he explains that denials apply both to what is and to what is not. But it was not part of his position that the principle holds for all affirmations. In the *Topics* (121a22–4) Aristotle asserts that what is not is thinkable (δοξαστόν), but, true to the principle of non-contradiction, he denies that what is not is.

Some affirmations ('he is dead') are being-excluding, and some ('it is thinkable') are being-independent. The general rule is that, to tell what being-commitments are carried by a predication, one has to consider the predication's sense and not just its form. Aristotle could consistently maintain that the principle holds for verbs because he did not count 'is a non-being' or 'is thinkable' as verbs.

The position put forward in the logical works appears to have undergone a development in *Metaphysics* 1003a5–10, where Aristotle seems to allow that *any* thought whose subject is *a* implies that *a* is *in some sense* a being. On this doctrine, '*a* is *b*' always implies '*a* is'; but the sense of the latter may vary with that of the former. Even 'What is not is what is not' implies 'What is not is', though the final 'is' here does not have the same sense as in 'Socrates is'. Thus, compatible with this new doctrine, a sense can still be found in which 'What is not is what is not' does *not* imply 'What is not is'.

Aristotle's logical system requires that both universal and particular affirmations have existential import, in the sense that the propositions 'Every *a* is a *b*' and 'Some *a* is a *b*' both equally imply that there are *a*'s. This requirement obtains no matter what terms are substituted for '*a*' and '*b*', since Aristotle's logic is a formal one. But in his ontology, whether a proposition implies the being of its subject depends on what its terms are. It is not simply a matter of the proposition's logical form. Thus, from a logical point of view, the proposition 'All non-beings are non-beings' implies that there are non-beings. But ontologically the proposition does not imply that non-beings are (except in the sense given in *Met.* 1003a5–10).

This apparent conflict between logical and metaphysical theory shows up at *Physics* 221b23–25, where Aristotle seems happy to name what is not. The context makes it clear that this name applies *inter alia* to what is not the case:

> It is manifest, therefore, that not everything that is not will be in time either; for example, all the things that cannot be otherwise (than not being), like the diagonal's being commensurate with the side.

The conflict can be resolved by supposing Aristotle to have rejected the thesis of the pervasiveness of being. Some things, for instance the goat-stag, are not beings. And what the so-called existential import of categorical affirmations amounts to is that such propositions imply that *something* is a member of the subject class, but not that that something is a being. Consequently, the quantification that is appropriate to Aristotle's logic is substitutional not objectual.

In addition to rejecting the pervasiveness of being, Aristotle rejected its necessity, on the ground that many ordinary predicates turn out on analysis to involve the ascription of unactualized potentialities to things:

> For it is clear that on this view a man will not be a builder unless he is building (for to be a builder is to be able to build), and so with the other arts . . .

And similarly with regard to lifeless things; nothing will be either cold or hot or sweet or perceptible at all if people are not perceiving it . . . indeed, nothing will even have perception if it is not perceiving, i.e. exercising its perception. If, then, that is blind which has not sight though it would naturally have it, when it would naturally have it and when it still exists, then the same people will be blind many times in the day – and deaf too (*Met.* 1046b33–1047a10).

Beings, according to Aristotle, do not form a genus (*Met.* 998b22–7). His ontology is heterogeneous in three distinct ways, only one of which is found in Plato; but the structure whereby derivative beings are derived from primary beings is the same as in Plato.

1. *Per accidens* beings are derivative on *per se* beings. Among *per accidens* beings, Aristotle distinguished paronyms and compounds. Paronyms, such as the brave, are beings, because they stand in relation μ to some *per se* being, in this case *bravery* (*Cat.* 1a12–15). Compounds, such as pale musicians or pale men, have at least one of their components related by μ to a *per se* being (in these cases to *pallor*) (*Met.* 1017a7–30). *Per se* beings are beings which are not, and do not have a component which is, related by μ to anything.
2. Individuals are prior to universals. There are universal beings, but only because there are individuals corresponding to them. Aristotle says that a universal is *said of* its corresponding individuals: thus, the universal *horse* is, but only because it is said of some individual horse (*Cat.* 2b5–6).

   Individuals are those *per se* beings that are not said of anything (*Cat.* 1b6–7): individuals are the limits of chains of *said of* relations. For Aristotle the 'said of' relation is a member of the class of relations *R* of ontological dependence. On this point his position is at odds not only with Plato's, but with the whole metaphysical tradition according to which what is most real is the same as what is most intelligible: for Aristotle did not believe that individuals are more intelligible than universals.
3. *Per se* beings divide into substances and accidents. Accidents do, and substances do not, have something standing to them in relation μ. Substances are prior to accidents. Accidents are, but only because they are *present in* substances. Thus, *bravery* is, but only because it is present in men.

   Substances are those *per se* beings which are not present in anything, and thus stand at the end of chains of *present in* relations (*Cat.* 3a7).

According to the *Categories*, the beings* are individual substances:

A *substance* – that which is called a substance most strictly, primarily, and most of all – is that which is neither said of a subject nor in a subject, e.g. the individual man or the individual horse (*Cat.* 2a11–14).

The class *R* according to Aristotle includes in addition to μ the *said of* and *present in* relations.

For Aristotle, as for Plato, there is a class *N* of names corresponding to whose members there are abstract beings. Aristotle is relatively clear about the membership of *N*. It includes the names of paronyms (*Cat.* 1a12–15), i.e. concrete names semantically derived from the names of universal accidents, as 'brave' is derived from 'bravery': to be brave means to possess bravery. *N* excludes names of substances, negated names, and the name 'being'; and in all these ways, Aristotle differs from Plato regarding the membership of *N*.

In the *Categories* and the other logical works, *N* also excludes singular names and abstract names. There are in those works no abstract names such as 'Socrates-ness', or 'whiteness-ness', from which singular concrete names, or abstract names such as 'whiteness', might be semantically derived.

In Aristotle's later works his ontology underwent two major changes. It came to include further classes of beings besides those which are recognized in the *Categories*; and it came to regard the beings* as something other than concrete individuals. In contrast to the *Categories*, the *Metaphysics* does contain second-order abstract names, as well as abstract names from which names of sub-

stances are semantically derivative. There Aristotle writes about *essences*, i.e. abstract beings such as being-a-man or being-white or even being-Socrates (*Met.* 1032a8).

Aristotle's treatment of abstract being in the *Metaphysics* compares as follows with Plato's:

1. Aristotle agrees with Plato that if there is a name '*a**' of an abstract being, then whatever is *a* is so by virtue of being related by the relation μ to *a**. A man is a man because he embodies the essence being-a-man; moreover, Aristotle thinks that it is a man's embodying this essence which renders him intelligible (*Met.* Z6). In this way he returns to something very like the Platonic theory that it was a thing's relation to the Forms that made it intelligible.
2. Plainly if Plato's theory of Forms names for Forms are singular abstract names. This point was appreciated by Aristotle, who noted that the premisses 'Animal is two-footed' and 'Animal is many-footed' will commit us to the impossible conclusion 'What is two-footed is many-footed' if we take the Form Animal to be a 'this' (*Met.* 1039b2–4), i.e. if we take names for Forms to be singular names. Aristotle repeatedly accuses Plato of making the Forms individuals, and obviously thought Plato had made a serious error in this matter. His position in the *Metaphysics*, in contrast to the earlier theory of the *Categories*, is that not all names of the form '*a**' are singular.

   All the same, some abstract names must be singular, given that in *Metaphysics* Z names of essences such as 'being a man' either are singular names or have singular names, such as 'being this man', falling under them.
3. Abstract beings do not, according to Aristotle, exist separately from concrete beings but in them. Walking exists, not (as Plato had thought) separately from walkers, but in them (*Met.* 1028a20–5).

   According to *Metaphysics* Z6, the beings*) are not concrete individuals themselves but their essences. Thus Aristotle returned to the orthodox identification of what is most intelligible with what is most real. He came to regard individual substances as posterior to essences because he came to think of them as compounded from matter and form/essence (*Met.* 1033a31–b5). Moreover, he came to think of matter as potentiality and form as actuality (*Met.* 1071a7–11). Most eminent among beings*, according to this regained orthodoxy, is an eternal unchanging Intellect which is pure actuality – thought thinking itself (*Met.* Λ7).

Plotinus. Elements of Parmenideanism, Platonism, and Aristotelianism were brought together in a unique synthesis by Plotinus. Plotinus's sole being* was the One. All other beings stand to it in the relation of *emanation*. This relation he compared to the radiation of light or heat, and to the diffusion of perfumes (*Enn.* V.1.6). The procession of beings starts with being or intellect (derived from *Met.* Λ, but also incorporating the Platonic Forms). It goes on to Soul, passing through all possible grades of being, and ending with matter (V.1.10). All beings finally revert to the One.

The philosophy of Parmenides is here given a mystical turn. Plotinus wrote about the access intellect has to the One as something which excludes all predication. The latter, he says, is:

> truly ineffable: for whatever you say about it, you will always be speaking of a 'something'. But 'beyond all things and beyond the supreme majesty of the Intellect' is the only one of all the ways of speaking of it which is true; it is not its name, but says that it is not one of all things and 'has no name', because we can truly say nothing of it: we can only try, as far as possible, to make signs to ourselves about it (V.3.13).

Such a mysticism remains compatible with a version of Parmenides's principle according to which every subject of affirmations has being. The One is but does not have being (*Enn.* VI.7.38.1–9). It is a subject of denials but not of affirmations:

we have it in such a way that we speak about it, but do not speak it. For we say what it is not, but we do not say what it is (V.3.14.5–7).

Plotinus did not accept the pervasiveness of being. The One and matter are, in different ways, not beings. The One, like Plato's Form of the Good (*Rep.* VI, 509b), is 'beyond being'. It is formless, not in the sense that it needs form (as matter does), but in the sense that it is the source of all form (VI.7.9–10).

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Metaphysics III: Metaphysics of Analytic Philosophy

G. E. Moore. It is generally agreed that analytic philosophy originated in the early 1900s at Cambridge University, when G. E. Moore and Bertrand Russell revolted against the prevailing idealism represented by such figures as F. H. Bradley and J. M. E. McTaggart. According to Russell, Moore was the early leader in the revolt. Although Moore placed great emphasis on clarity of exposition, caution in drawing distinctions, and careful detail in argument, his analytic procedure was focused not on language but on 'concepts and propositions', which words and sentences, in his view, stand for or express. Moore's conception of his procedure disclosed an ontological view that was partly Platonistic, for he regarded concepts as non-subjective, eternal, and immutable objects of thought. He did not, however, provide a satisfactory account of how these objects were analysed. In *Principia Ethica* (1903) he described a non-verbal definition of an object of thought (his example was *horse*) as specifying its 'parts and their arrangement', as if concepts are organized wholes structurally analogous to their instances. Late in his career he expressed uncertainty about the nature of analysis. The correct analysis of the concept *brother*, he said, is *male sibling*. The analysis here is properly expressed by an identity statement, which identifies the concept *brother* with the concept *male sibling*. But this claim raises, as he admitted, a 'paradox of analysis': if the different words used to express the analysis express (or represent) the very same concept, they must be synonymous, in which case the assertion they are used to make conveys no information to anyone who understands it; yet if the different words are not synonymous, the analysis they express cannot be correct. Moore never succeeded in resolving this paradox.

Although Moore characterized metaphysics as concerned with "supersensible reality" or "things that are real but are not part of nature" (*Principia Ethica*, pp. 110f.), much of his thinking was concerned with another subject that would be considered a part of metaphysics today: the ontological structure of the natural world. Moore claimed that he knew that common-sense objects (tables and chairs, trees and mountains) existed, but he was uncertain about the 'analysis' of this knowledge. Looking at his hand, he was aware of a sense datum, a pinkish patch of colour, but he was uncertain whether the patch was actually part of the surface of his hand, something representing that surface, or something that, along with other actual and possible sense data, in some way constituted the hand. The 'analysis' of this knowledge amounted to the analysis of the concept *physical object*, a task that Moore was never confident that he carried out satisfactorily.

Russell. Russell's form of analysis was initially close to Moore's, though it was generally less informal and not restricted to common-sense concerns. One fairly constant principle in his philosophy was that of 'acquaintance': any proposition that we can understand must consist of (or, later, must be analysable into expressions referring to

nothing other than) entities with which we are acquainted. From an ontological point of view, we are acquainted with just two sorts of entity, particulars and universals. Early in his career Russell's universals were the same as Moore's concepts: one and the same universal (e.g. redness) could be (or be exemplified) at different places at the same time. The particulars he said he was acquainted with were (on the whole) momentary objects of sense, which he called 'sense data'. Like Moore, Russell spoke of other sorts of particulars, sometimes saying that they are known 'by description'. But to avoid 'metaphysical entities' – that is, objects of a 'supersensible reality', as Moore described them – he later espoused the maxim, "Whenever possible, logical constructions are to be substituted for inferred entities" (*Mysticism and Logic*, 1918, p. 155).

Russell's conception of a logical construction was facilitated by the development of his theory of descriptions, which F. P. Ramsey called 'a paradigm of philosophy'. This theory was concerned with the import of descriptive phrases such as 'the present king of France'. These phrases are problematic because they may lack a referent and yet appear in meaningful sentences that are true or false. Russell argued that these phrases are really 'incomplete symbols' that have meaning only in the context of a sentence. If 'B' is a predicate joined to a definite description '$(\iota x)(Fx)$,' the resulting sentence '$B(\iota x)(Fx)$' is 'contextually definable' as meaning '$(\exists x)((\forall y)(Fy \equiv x = y) \ \& \ Bx)$'. Since the formula '$\neg B(\iota x)(Fx)$' may usually be interpreted as a simple denial of the inner formula 'Bx', Russell's treatment of definite descriptions has the consequence that a sentence containing a definite description not satisfied by any existing thing may yet be true. The mere use of a definite description in a sentence cannot commit us, therefore, to the existence of an object or thing satisfying that description. This is the basis for Russell's maxim concerning logical constructions. His idea was that when we are not acquainted with the supposed referents of various terms in ostensibly true propositions, we are well advised to interpret those terms as incomplete symbols. Things whose existence as irreducible objects would be very difficult to ascertain are those supposedly referred to by such terms as 'the mind of Jones', 'the table in the next room', 'space', 'time', 'the class of animals', 'the number two', and 'the square root of minus 2'. Russell argued that they should all be viewed as incomplete symbols.

Russell's initial work as a metaphysician (roughly from 1900 to 1910) was concerned with mathematics. His most important results were achieved in conjunction with his teacher, A. N. Whitehead, in the monumental *Principia Mathematica* (3 vols., 1910–13). In this work the authors offered a detailed reduction of mathematics to logic. The reduction consisted in treating mathematical objects (e.g., numbers of various sorts) as logical constructions, and in showing that truths about them are ultimately inferable from ostensibly logical axioms.

Russell's later metaphysical work (roughly from 1910 to about 1926, with sporadic contributions as late as 1948) was mainly concerned with the world of mind and nature. In several important books he attempted to interpret ordinary physical objects (e.g., tables and chairs) as well as time, space, and the micro-objects of physics as 'logical constructions out of sense data'. An interesting feature of this work is that the method he used was much less analytical than constructive. Russell did not start with some concept – that of time, say – and then, by some purely analytical process, discover that it is actually identical with a certain complex construction. Rather, he started with a certain family of assumptions ostensibly about time and then showed that their truth would be preserved if the associated temporal concepts were understood as constructions. Rudolf Carnap, an admirer of Russell, would later describe this procedure as one of 'rationally reconstructing' a subject matter.

Frege. A forerunner of Russell who has assumed an important place in analytical philosophy largely because of his influence on Russell and Carnap was the mathematician, Gottlob Frege. Like Russell, Frege was a 'logicist' in mathematics, but his contributions to metaphysics were not limited to that subject. His basic ontology was original,

consisting of two categories of entity: objects and functions. Like Russell's particulars, Frege's objects were the referents of singular terms, but they were not always concrete entities located in space and time. Russell's concepts, for Frege, were a special case of functions, but they were otherwise very different, being peculiarly 'unsaturated' (*ungesättigt*) entities with objects falling under them and having, for various arguments, the True and the False as values. The modern practice of representing the logical form of the sentence 'Socrates is wise' by '$W(s)$' derives from Frege's interpretation of predicates. If Socrates is wise, the value of the relevant concept for the object Socrates is the True – an idea we could represent by the equation '$W(s) = T$'.

Wittgenstein. Perhaps the first distinctively linguistic analytic philosopher was Ludwig Wittgenstein, a student of Russell who was also strongly influenced by Frege. The metaphysical view disclosed in Wittgenstein's *Tractatus Logico-Philosophicus* was developed hand-in-hand with a theory of language. Elementary propositions, he said, are combinations of names that represent objects; all other propositions are truth-functions of elementary ones. If an elementary proposition is true, it pictures a fact, which consists of objects in some kind of combination. The world is the totality of these facts; it is not a totality of things. Since we can think only by means of language, "the limits of our language", he said, "are the limits of our world". The 'inexpressible' shows itself, he conceded by the limits of language; what is thus shown is 'the mystical' (*das Mystische*). When people attempt to say something metaphysical, he adds, they invariably fail to give meaning to certain signs in their propositions. The right method in philosophy, he concludes, is to say only what can be said, the subject of natural science, and to show that metaphysical utterances are meaningless. This conception of philosophical method was seized upon by members of the Vienna Circle such as Carnap and also, later, by writers such as A. J. Ayer (1910–88) (known as 'logical positivists'), who attracted great notoriety by their claim that metaphysical assertions are not false but meaningless because unverifiable.

In his later *Philosophical Investigations* Wittgenstein abandoned the characteristic claims of his *Tractatus*, claiming that actual language cannot be supposed to possess the precise structure he had previously described. Failure to understand the actual use of words and sentences was responsible, he said, for the illusions of metaphysics, the latter subject being, for him, a combination of illusion, confusion, and nonsense to which philosophers are unwittingly attracted by the 'bewitchment' of language. The analysis of language that he practised in his later period was, on the whole, descriptive of actual use in concrete or specific circumstances. The result was (again, on the whole) a kind of therapeutic positivism – one in which a confused metaphysical fly is shown the way out of the 'fly-bottle'.

P. F. Strawson. Although linguistic analysts influenced by Wittgenstein's later views were usually highly critical (if not contemptuous) of metaphysics, P. F. Strawson was an important exception. In his *Individuals* (1959), subtitled "An Essay in Descriptive Metaphysics", Strawson distinguished 'descriptive' from 'revisionary' metaphysics, claiming that the former, which he practised, was concerned with mapping out the 'general structure' of language and thereby ascertaining the categorial structure of the world as the latter is commonly understood or represented in language. Strawson did not claim that revisionary metaphysics (the sort practised by Leibniz, George Berkeley, or Russell) is intrinsically objectionable, but he thought its usefulness was limited to the light it cast on problems of descriptive metaphysics. He insisted that progress in the latter required close attention to the actual use of words, but the reasoning by which he reached his conclusions in descriptive metaphysics was often focused not on the actual use of words but on what must be true about the world if words can successfully serve their intended function. One of his conclusions in this regard is that the world must consist of basic particulars located in an objective space-time framework. Such particulars are, he argued, material objects and persons, the latter being unitary particulars to which both material-object predicates and *P*-predicates

(roughly, mentalistic predicates) are truly ascribable.

Quine. A distinction of great importance to the analytic tradition is that between analytic and synthetic truth, the former being knowable 'by analysis'. Although this distinction had been in use since the 18th century, drawn explicitly by Kant but in effect assumed by David Hume, W. V. O. Quine attacked it in a famous 'analytic' paper, "Two Dogmas of Empiricism". Quine's attack proved to be highly influential and changed the course of analytic philosophy. Denying that truths could be known by a purely *a priori* analytic strategy, Quine claimed that all beliefs "face the tribunal of experience" and do so "as a collective whole", any particular belief being subject to possible revision, however abstract and formal. Since all beliefs face this common tribunal, there can be, Quine said, no 'first philosophy'; there is just science. Quine did allow a reflective, clarifying role for philosophy, however; and he was the leader in making ontology (as he understood it) a respectable subject in English-speaking countries. As he argued in *Word and Object*, a philosopher can clarify scientific claims by recasting them in a 'canonical notation' featuring the symbolism of modern logic; and critical reflection on the sort (or category) of entities that must exist if the claims of 'total science' are true can provide the basis for a scientifically respectable ontology. Entities of a category admissible into such an ontology must satisfy statable criteria of identity, a paradigm being the set-theoretical principle that set A is identical to set B just when A and B have the same members. Quine's ontology has always consisted of individuals and sets; he regards the latter as indispensable for the requirements of mathematics and physics.

Quine was greatly influenced by Russell, and his famous criterion of 'ontological commitment' was meant, in part, as an improvement on Russell's "Principle of Acquaintance". Russell thought the latter disclosed the ontological implications of elementary propositions, but Quine insisted that ordinary names may, like 'Pegasus', lack a referent and that predicates do not have referents at all: instead of standing for objects (as Russell thought), predicates are *true of* them. The ontological implications of a statement can be accurately identified, Quine claimed, only by the explicitly existential statements it implies. In a canonical language such statements are existentially quantified, of the form '$((\exists x)(\ldots x\ldots)$', and they are true just when the formula bound by the quantifier, '$(\ldots x\ldots)$', is true of or satisfied by some 'value' of the variable 'x'. Quine thus proposed that a reasonable criterion of ontological commitment is given by the principle that one's discourse or theory (something identifiable by the assertions one is prepared to make) commits one to all entities that must be counted as values of one's variables if one's discourse or theory is true. His criterion has been associated with the often misunderstood slogan 'to be is to be the value of a variable'.

Quine's later views on ontology are complicated by his doctrines of translational and referential indeterminacy. Although he had always complained about the 'obscurity' of talk about meaning, he approached the subject positively in *Word and Object* (1960), asking how a 'field linguist' might reasonably construct and justify a 'manual of translation' for the verbal behaviour of a group of people hitherto unknown to the scientific community. The general conclusion he reached was that "manuals for translating one language into another can be set up in divergent ways, all compatible with the totality of speech dispositions, yet incompatible with one another". Since each such manual is equally supported by the evidence, no one of them, he added, is any more correct than the others. A translation for a particular utterance is acceptable, therefore, only in a relative sense: it is acceptable or correct in relation to a chosen manual, but not otherwise. An analogous point holds for reference and truth. Since the reference of a term or the truth of a sentence depends on its interpretation, our assignments of reference and truth are as relative as our interpretations or translations. This conception of reference is different from the conception implicit in his criterion of ontological commitment. According to his later view, no theory or discourse has, 'absolutely speaking', a

particular ontological commitment; in fact, "to say what objects someone is talking about is to say no more than how we propose to translate his terms into ours" (*Theories and Things*, 1981, p. 20).

Later Developments. Largely as a result of Quine's influence, philosophers in the analytic tradition began to interpret language rather than attempt to analyse determinate, pre-existing meanings or concepts. Such interpretation took the form of assigning 'truth-conditions' to sentences and constructing semantical theories from which the desired truth-conditions were inferable. Two former students of Quine became particularly influential in this regard. Donald Davidson urged a purely extensional semantics modelled on the structure of Alfred Tarski's 'semantic definition' of a truth-predicate for formalized languages. Saul Kripke, on the other hand, having invented a widely admired semantics for modal logic, excited great interest in the intensional notions Quine had viewed with great suspicion: possibility, necessity, and the like. Reinforced by work in linguistics by N. Chomsky and in intensional logic by Carnap, R. Montague, and D. Kaplan, many philosophers began to interpret language by reference to possible worlds, states of affairs, abstract propositions, properties, and relations-in-intension. Among philosophers taking this latter approach, the doctrine of 'modal realism' became popular: possible worlds and even, sometimes, possible individuals were declared to be as real as the actual world and actual individuals. It was not uncommon for modal realists to speak freely of individual essences and other 'objects' reminiscent of Aristotelian or scholastic ontology. R. Chisholm was a particularly influential advocate of such objects.

As the interest in intensional logic, modal realism, and even neo-Cartesianism spread throughout the analytic community, a contrasting tradition suspicious of *abstracta* – of necessities, possibilities, abstract propositions, universals (properties and relations), and even, sometimes, sets – continued to exist and develop. Quine remained in the tradition, as did Nelson Goodman, Davidson, and Wilfrid Sellars – all of whom did important, original work of a broadly naturalistic, even nominalistic sort, and influenced others. Two younger members of this tradition who have taken a sharply contrasting line to that of coeval modal realists are H. Putnam and B. van Fraassen, whose work has, in significant respects, a positivist cast. Putnam has repudiated 'metaphysical realism' in favour of what he calls 'internal realism', a view implying that the world exists only as something structured by a conceptual scheme and that truth consists not in a 'correspondence' of proposition and language-independent objects but in 'idealized rational acceptability'. Van Fraassen has repudiated not only modal realism but the scientific realism of such writers as Sellars and J. J. C. Smart. According to van Fraassen, to accept a scientific theory is not to be committed to the actual existence of the objects the theory ostensibly postulates; it is merely to be committed to the 'observational adequacy' of the theory.

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BRUCE AUNE

Metaphysics IV: Contemporary French Metaphysics

Since World War II, the attitude of French philosophers towards ontology has been somewhat ambiguous. On the one hand, they have tried to overthrow the traditional concerns and distinctions of metaphysics; but, on the other hand, these attempts have resulted in doctrines which seem hardly less metaphysical and hardly less indebted to traditional distinctions than those they tried to undermine.

Contemporary French philosophy is the product of two sources of influence. The first is the tradition of 19th-century French 'idealism' or 'spiritualism', which taught that being is equivalent to being known by the mind, the contents of which can be grasped through reflexive analysis. As Léon Brunschwicg (1869–1944) liked to say, the history of Egypt amounts to the history of Egyptology. The second is German philosophy, which came in two successive triads: Hegel, Edmund Husserl, and Martin Heidegger, followed by the so-called 'philosophers of suspicion', Karl Marx (1818–83), Friedrich Wilhelm Nietzsche (1844–1900), and Sigmund Freud (1856–1939). The second tradition has been interpreted in the light of the first, and was more often the product of an acclimatization to the specific climate of French spiritualism rather than the product of a real dialogue.

The French Version of Phenomenology. Most French philosophers of the post-war period thought that phenomenology could open the path to a new form of philosophy, free from any commitment to the classical problems and solutions of metaphysics. But the French version of phenomenology retains only a few themes from Husserl's transcendental idealism (e.g. intentionality and phenomenological description), and ignores the inspiration of the *Logical Investigations*. In particular the French phenomenologists have always put more emphasis on the idea of a phenomenology of subjectivity than on the Husserlian project of a 'formal ontology'. In other words, the Aristotelianism which was prevalent in the Franz Brentano-inspired phase of phenomenology has been absent from the French context, which has always been more Cartesian in spirit. The 'phenomenological ontology' of Jean-Paul Sartre's *Being and Nothingness* (1942) builds a theory of freedom upon the Hegelian categories of being 'in-itself' and being 'for-me'. According to Sartre, being and not-being are not independent logical or ontological categories; they are relative to, and made possible by, human consciousness, which constitutes itself by contrast with the world. Consciousness is in its essence a 'negative' power, which 'creates' nothingness, and this power is freedom itself. Sartre describes his work as an attempt to escape the alternative between realism and idealism; yet his conception can still most properly be described in traditional terms as a form of idealism, and it has many affinities with the French idealism of the 19th century. Whereas the French spiritualists, from Félix Ravaisson (1813–1900) to Henri Bergson (1859–1941), had located contingency inside nature or being, Sartre sees consciousness or subjectivity as the power to produce contingency in the realm of being, which is reduced to being-for-me.

The 'existential phenomenology' of Maurice Merleau-Ponty (1908–61) aimed to produce a version of idealism (in the sense of the thesis that the world exists only relative to consciousness) different from the tradition of French Cartesianism. The first step, in *The Structure of Behaviour* (1942), was an analysis of psychology. Here Merleau-Ponty takes the results of *Gestalttheorie* as refuting both behaviourism and the intellectualist analysis of psychological contents. He claims that behaviour is based upon irreducible intentional structures, but unlike the Gestalt theorists, he denies that these structures have any straightforwardly physical basis. They belong both to the physical and to the spiritual world. The fact that there is a common basis of the mental and the physical provides a solution to the mind-body problem. According to Merleau-Ponty, this ontology (largely inspired by Kurt Goldstein (1878–1965)) is neither monistic nor dualistic. It echoes Emile Boutroux's (1845–1921) and Henri Bergson's contingentist ontology: from physics to psychology there is a hierarchy of forms, where the 'superior' (or intentional, or spiritual) structures are not causally determined by the 'inferior' (or physical) structures. The meeting-point between body and mind, and between subjectivity and objectivity, is the world of perceptual experience.

Merleau-Ponty's second step, accordingly, was an investigation of the structure of perception, considered as the transcendental basis of an objective world. The *Phenomenology of Perception* in particular consists in an analysis of the role of the body in the structuring of spatiality and temporality. Phenomenology, according to Merleau-Ponty, is not

a search for essences; it is an attempt to describe the world of experience (Husserl's '*Lebenswelt*') as the ultimate foundation of objective truth. In his later works this analysis of perception is taken further in an account of the embodiment of thought in various forms of artistic expression, in particular in literature and painting. The work of art is, like perceptual experience, the manifestation of what Merleau-Ponty called "an ontology of the sensible world", which was for him the ultimate foundation of every being.

'Structuralist' Philosophy. Because of its insistence on structures, considered as forms intermediate between nature and consciousness, Merleau-Ponty's philosophy can be considered as a 'structuralist' philosophy before the letter of structuralism. He was, however, reluctant to divorce the 'subjective' point of view of consciousness from the 'objective' symbolic structures analysed by the 'structuralist' linguists and anthropologists, structures which he interpreted rather along the same lines as the Gestalten of psychology, as forms created by consciousness. The structuralism of the 1960s, in contrast, insisted upon the objectivity and mind-independence of structures. But such structuralism was not much more than a scientific (mostly comparative) methodology in the field of the human sciences (mostly in linguistics). That it does not carry any positive ontology of its own mattered little for those structuralist philosophers who intended mostly to criticize through it the premisses of phenomenology, and apart from G. Granger, no serious attempt was made to analyse the notion of form and structure in the human sciences.

Thus Jacques Derrida's criticism of Husserlian phenomenology in his *Speech and Phenomenon* (1967) isolates in Husserl's theory of meaning the concept of 'living present' as the root of the concept of being of the whole metaphysical tradition. But the essence of meaning, according to Derrida, resides in the use of written signs rather than in the use of spoken ones. Only in the former can the necessary *absence* of the referent of a sign be revealed. Derrida's reasoning seems to be based on the following 'argument': (a) the world is a kind of text, or what a text is about, (b) every text and writing implies the disappearance of its referent or of the 'presence' which it designates, (c) therefore the world itself – as the referent of the 'text' – disappears. Metaphysics being itself a text 'about' being and the world, its object disappears as well.

This radicalization of Heideggerian hermeneutics leads to a negative ontology, devoted to an indefinite 'deconstruction' of the so-called 'text' of metaphysics. Being, as pure presence, can never be revealed in itself. This reasoning seems to be based on the structuralist premiss that the study of signs does not call for an analysis of their reference, but only of their meanings as revealed in the 'structures' which they exemplify. This requirement, which may be justified in linguistics, is elevated by the structuralist philosophers to the status of an axiom: words do not refer to things. And this axiom leads to the plain idealist conclusion that our language does not bear on any reality at all. Our language floats in isolation, unhooked to any reference to things.

As Vincent Descombes (1979) has shown, contemporary French philosophy has been dominated also by a debate with Hegelianism. Here Nietzsche has been the main source of inspiration for thinkers such as Gilles Deleuze and Michel Foucault (1926–84). Nietzsche held that values and forces were the ultimate components of being. But a value or a force is not an entity that can be captured by criteria of identity or of individuation. It only differs from other values or forces. It is, therefore, 'pure' difference, not a difference which amounts to a negative determination of some common standard. Life itself is a process of differentiation of the living kinds, which is, in the manner of Bergson's '*élan vital*' free from any previous determination. Gilles Deleuze's 'philosophy of difference' in his *Difference and Repetition* (1968) traces out the negative consequences of these claims for metaphysics. The latter, he argues, can only 'represent' things as being such and such. It is therefore incapable of thinking 'Difference in itself', which escapes any kind of representation. The question arises whether this version of Nietzscheanism

can be distinct from relativism or nihilism.

Writers in the phenomenological tradition, too, have attempted, like the post-Heideggerian structuralists, to replace metaphysics by another sort of 'discourse': by ethics (Emmanuel Levinas, *Totality and Infinity*, 1961), or by a philosophical hermeneutics (Paul Ricoeur, *On Interpretation*, 1965), or by an analysis of affectivity along the lines of Maine de Biran (1766–1824) (Michel Henry, *The Essence of Manifestation*, 1963).

The great absence in contemporary French ontology is realism. As Etienne Gilson already remarked in his *Being and Essence* (1948), the existentialists' distrust of ontological realism could hardly lead to any ontology at all. Although phenomenology was the dominant inspiration, the Husserlian project of founding the objectivity of mathematical and logical truth on intuition remained ignored (see nevertheless the critical assessment of this project in Vuillemin 1960). Because of their idealistic biases, very few French philosophers believed in the objectivity of scientific truth, let alone the objectivity of mathematical and logical truths. Despite the heritage of the 19th-century philosophy of nature, and despite their emphasis on the notions of form and structure, French philosophers have failed to renew the idea of a realistic ontology of forms. The work of the mathematician René Thom, who attempts to base in ontological categories the spatial and geometrical forms discovered in the study of nature, is a possible exception to the dominant idealistic line of thought in contemporary French philosophy, which announces a reversion to a species of Aristotelian realism long absent from the French tradition.

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PASCAL ENGEL

Metaphysics V: Probabilistic Metaphysics

It is uncommon to claim that probability should be regarded as a fundamental metaphysical concept. The traditional focus of metaphysics is on the nature of being, the nature of substance, the nature of space and time, and similar concepts. On the other hand, it is evident that from the standpoint of contemporary science, the probabilistic character of phenomena is nearly as ubiquitous as their spatial or temporal character.

There are certain general propositions that reflect the nature of probabilistic metaphysics. These propositions are not all accepted but each of them has a serious defence, and a close relation to contemporary scientific work. Five such propositions are given with brief comments on each.

(1) *The fundamental laws of natural phenomena are essentially probabilistic in character.* The defence of this proposition, which is far removed from central theses of traditional metaphysics, is the probabilistic character of the main fundamental theories of matter and energy in the 20th century, namely, quantum mechanics and quantum field theory. There have been and there will continue to be efforts to develop deterministic theories of quantum phenomena, but the general assessment is that these efforts have as yet been unsuccessful. Moreover, the fundamental probabilistic element of the phenomena will remain with or without the subsequent development of such theories. Examples would be the transition probabilities for states of the hydrogen atom or the radioactive decay of substances such as radium.

(2) *Our conception of matter must contain an intrinsic probabilistic element.* The defence of this proposition again rests on the fundamental theories of physics just mentioned. The contrast with the concepts of matter to be found for example in Aristotle or René Descartes is apparent, although it is possible that a revision of Aristotle's ideas of matter could accommodate modern views.

(3) *Causality is probabilistic in character.* In older popular accounts the idea of causality being intrinsically probabilistic would cer-

tainly be unacceptable. The classical dictum has been that where there exists a difference in effects there must exist a difference in causes. But this is just what a probabilistic theory does not accept as an essential ingredient of a theory of causality. The best physical example is radioactive decay of a substance such as radium or uranium. Differences in the decay times of pure atoms of a given substance do not indicate a difference in causes according to the standard probabilistic theory of such decay.

There is another aspect that is perhaps more important. A probabilistic analysis of causes is the only possibility for intrinsically complex phenomena. It is important to emphasize that not all traditional metaphysics has been deeply concerned with the ultimate nature of being or ultimate causes. Philosophers such as William James and John Dewey (1859–1952) have been more concerned with the phenomenology of experience as the right approach to metaphysics, although this is not meant to suggest that they were purely phenomenologists. The point is that it can be an appropriate part of metaphysics to be concerned with the complexity of phenomena and how a general theory can be developed to account for this complexity. The theory of probabilistic causality constitutes one such approach. An agnostic standpoint toward ultimate causes can be taken but the need for dealing with causal ideas in a probabilistic framework can be seen as the only computationally feasible possibility. Of course, the idea of computational feasibility is itself not at all a classical metaphysical conception but one that is very much in order as part of current scientific thinking. There is an important metaphysical distinction to be made between phenomena that are computationally accessible and those that are not. Probabilistic causality is one way of dealing with such complexity.

(4) *Certainty of knowledge is in general unachievable.* From Descartes to Bertrand Russell, a central theme of modern philosophy has been to characterize methods by which certainty of knowledge can be established. The concept of sense-data has been central to the search for certainty in the foundations of empirical knowledge. Modern scientific theories of perception have cast serious doubts on the possibility of such knowledge, because of the impact of past experience and present context on 'direct' perception of phenomena. In the case of scientific knowledge acquired through experimentation and procedures of measurement, the central role of variability in the phenomena and errors in the procedures of measurement has made certainty of results generally unattainable. Probabilistic analysis is the natural methodology in such circumstances, supported as it is by such fundamental theoretical results as the Heisenberg uncertainty principle in quantum mechanics.

(5) *The collection of scientific theories is not converging to some bounded fixed result that will in the limit give us complete knowledge of the universe.* A common philosophical conception of science is that it is an ever closer approximation to a set of eternal truths that hold always and everywhere. This conception of science has ancient antecedents in Plato and Aristotle. A good example would be the theory of demonstration of scientific propositions in Aristotle's *Posterior Analytics*. This same conception of science has dominated modern philosophy with Descartes and Kant as the most prominent exponents. To be contrasted with this is the view congenial to C. S. Peirce and Dewey among modern philosophers. Scientific activity is a kind of perpetual problem-solving. The aim of enquiry is to settle a particular problem, not to provide all truths of a relevant nature. The modern theories of complexity already alluded to buttress this view. From many directions a good argument can be made that all the relevant details of many complex phenomena are computationally inaccessible. Our knowledge of such phenomena must remain incomplete. Probabilistic metaphysics is designed to deal with such uncertainty and incompleteness.

It should be emphasized that such a view of scientific theory does not imply that we do not increase our knowledge of given phenomena as one theory is succeeded by another. The vivid image to be held in mind as a way of thinking about the unbounded character of experience and what is to be discovered about it is a sequence of increasing integers.

It is not at all necessary that such a sequence converge to a fixed finite limit, just as it is not given that increasing knowledge of the universe will converge to a closed view. In fact, probabilistic metaphysics is in many respects quite congenial with William James's concept of the open universe.

Other Propositions. The five propositions I have discussed are not meant to characterize in any detailed way probabilistic metaphysics. It would be part of the theory itself that no simple set of general propositions would give an adequate characterization. Apart from this general remark, probabilistic metaphysics is also concerned with the plurality of science as well as with the incompleteness of it. The evidence is rather good that the individual sciences are diverging, rather than converging as is often hoped by many speculative scientists. There is no particular reason to believe that we shall see in science an increasing unification of language, subject matter, or method, but rather a continual divergence of all three, so that the understandability of what is transpiring at the frontiers of a given subdiscipline of science will be increasingly difficult of comprehension. Although there are general propositions of probabilistic metaphysics, the metaphysical analyses of particular scientific disciplines will also be different from each other.

In the same spirit, there is no general theory of rationality to guide our enquiries. The theory of rationality or of enquiry is also pluralistic and to a large extent probabilistic in character. Back of this view is a deeper one that the aims of enquiry are to a very large extent instrumental in character. Such a view of science and knowledge has had considerable currency in this century but the cognitive view of traditional metaphysics has held sway for a much longer period of time. Also, admittedly, there are difficulties with working out a purely instrumental view in a satisfactory way. One of the functions of a proper probabilistic metaphysics is to provide a proper place for both the instrumental and the cognitive view of enquiry. It is doubtful that at any time in the near future we can dissolve one into the other.

Another feature of probabilistic metaphysics is that it is intended to be descriptive and therefore continually subject to revision on the basis of new philosophical and scientific developments. The scientific theories of today will surely not be the theories of tomorrow. The same should be true of metaphysics.

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PATRICK SUPPES

Metaphysics VI: Systematic Metaphysics

There are two strands of work in philosophy that may be designated 'systematic metaphysics'. The first is exemplified by the work of Aristotle and Thomas Aquinas. Such philosophers *methodically* analyse a wide range of metaphysical concepts such as substance, attribute, universal, essence, existence, identity, cause, etc. The second strand is exemplified by the work of Spinoza and Leibniz. These philosophers construct *deductive systems* that organize some portion of the corpus of metaphysical issues and concepts. The present article focuses on this second kind of systematic metaphysics.

Contemporary advances in logic have brought new standards of clarity and rigour to the attempt to structure metaphysics as a deductive system. Philosophers have long been inspired by the example set by Euclid (fl. 300 BC) in mathematics, and have since cherished the idea that metaphysics should be organized as the most general, *a priori* deductive science. The advances in logic have left us with criteria for evaluating metaphysical theories that claim to be organized in

this way. These criteria reveal, for example, that Spinoza's heroic attempt at systematization in *The Ethics* is not successful as it stands; it is neither clear how most of the theorems are to be derived from the axioms and definitions, nor clear that the wide range of ideas can be defined in terms of a few powerful primitive notions. Consequently, our understanding of many of Spinoza's insights and their interconnections is to a large extent impaired, though they may yet find a more precise expression. Moreover, Leibniz's work on logical calculi was impeded by the fact that he conducted his research using Aristotelian subject/predicate logic as a paradigm. It was not until Gottlob Frege developed relation/argument logic and described the greater generality and rigour with which proofs could be carried out that new standards for defining the logical basis for deductive systems began to emerge.

We shall therefore confine our survey of systematic metaphysics to work that assimilates the results of contemporary logic. This means that we shall look primarily at developments in the 20th century, and identify work that is either explicitly organized as a deductive system, or is potentially so organized. To get some perspective on these developments, it will serve well to categorize the philosophers and their systems according to the kinds of entities they take as basic (i.e., according to what they utilize as the primitive domains of quantification). Four main categories emerge:

1. Philosophers who quantify only over individuals, rejecting sets, universals (i.e., properties and relations), and any other kind of abstract entity as basic.
2. Philosophers who, in addition to quantifying over individuals, quantify over sets or classes (in most cases, to avoid quantifying over universals).
3. Philosophers who, in addition to quantifying over individuals, explicitly quantify over universals as well.
4. Philosophers who, in addition to quantifying over both individuals and universals, postulate special domains of intentional or abstract objects.

These four categories are not exclusive; for example, some members of category (3) take sets as primitive. But these distinctions should nevertheless help us to structure the following discussion.

Category 1. The philosophers in this category are known as *nominalists*, and though the modern programme of nominalism was laid out in a paper co-authored by Nelson Goodman and W. V. O. Quine, Stanisław Leśniewski developed nominalistic systems much earlier. All three philosophers reacted to Russell's paradox by rejecting sets and properties (Leśniewski's 'collective classes' were mereological individuals subsumed by his ontology of individuals). Goodman and Quine explicitly renounce all abstract entities, and though the quantifiers of their deductive system range only over individuals, they acknowledge that there is some latitude as to what may count as an individual. The basic individuals of a nominalistic system may be physical objects, concrete events, 'units' of sense experience, or sensory events. Actually, a great deal of confusion surrounds this liberal attitude. Goodman, in his *The Structure of Appearance* (1951), allows anything whatsoever to count as an individual. Thus, any system in which universals are treated as individuals counts as nominalistic. In particular, Goodman's 1951 system, in which abstract, repeatable sensory qualities, or *qualia*, serve as the basic individuals of the system, qualifies as nominalistic (Goodman takes qualia to be universals). So Goodman essentially redefined nominalism – instead of being the metaphysical view that rejects abstract entities (and, in particular, classes and universals), he appears to take it as a view about language, namely, that the predicates of a language do not signify anything like classes or universals.

When conceived as a metaphysical foundation, nominalism faces at least three problems that have seemed insoluble:

(1) For those nominalists who reject classes and universals, and refuse to assume that there are infinitely many objects, the truths of mathematics become puzzling. These truths seem to require domains that have an infinite

population (such as the domain of numbers). Consequently, they are faced with the unenviable task of trying to account for mathematical truth with a potentially finite stock of objects.

(2) The truth definition for languages in which predicates do not signify classes or universals remains mysterious. How are predicates semantically significant? In virtue of what do they apply to the objects denoted by the individual terms?

(3) It is unclear that the primitive predicates of typical nominalist calculi are sufficient for analysing the wide range of statements that most of us accept. Nominalists typically restrict themselves to a limited set of predicates that apply to the basic individuals of the system (for example, Goodman uses just two 2-place predicates: 'overlap' and 'occurs with'). Consequently, they must not only find a way to construct individuals not basic to the system, but also reduce the predicates of these non-basic individuals to the predicates of the calculus. However, the individuals and predicates involved in modal and intensional (and intentional) statements prove to be particularly troublesome. How is the fact that Reagan might have had blond hair to be analysed in terms of these calculi? It is even doubtful whether all true statements about medium-sized physical objects can be reduced to such terms.

In all fairness, however, it should be said that Goodman does not regard his 1951 system to be a foundational system that organizes all of knowledge and reality, but rather as one of many systems that organize different parts of our experience, all of which are supposed to cohere together.

Category 2. To solve the problems sketched above, some philosophers extend their metaphysics to include sets or classes. Adding (an infinite number of) sets solves problems (1) and (2). With an infinity of mathematical objects, there is some hope of accounting for mathematical truth (especially if there is a way to reduce all statements in classical mathematics to statements about sets). With the addition of sets, the truth conditions for simple predications may be defined – a predicate F applies to an individual term x if and only if the object denoted by x is a member of the class denoted by F. However, another distinguishing feature of the philosophers in this category is their belief that by adding sets, problem (3), and other problems in the philosophy of language, may be solved as well.

The philosophers of category 2. fall into three main groups. The first is best exemplified by Rudolf Carnap, in his work *Der Logische Aufbau der Welt* (1928). In addition to classes, Carnap takes 'elementary experiences' as basic individuals. These are concrete phenomenal events that are momentary cross-sections of the full stream of experience. Carnap doesn't try to analyse these experiences into their constituent components, but rather organizes them into classes, some of which are 'logical (re)constructions' of abstract qualities. Carnap sketches briefly how more complex objects are to be logically constructed, but it is dubious that ordinary statements about such objects, much less modal and intentional idioms, can be analysed in these terms.

Quine and David Lewis are the best representatives of the second group. They take concrete physical objects and sets as their basic domains of quantification. Quine's work, in his *From a Logical Point of View* (1953), has been extremely influential, despite the fact that he does not take modal and intensional idioms seriously (he agrees that they cannot be reduced to non-modal and non-intentional idioms, but insists that they are nothing more than unsystematic talk). Lewis tries to deal with modal and intentional idioms, and his ideas are somewhat more sophisticated, if not as systematic (he does not clearly identify his primitive notions or first principles). Lewis uses spatio-temporal predicates to postulate an infinity of concrete alternative realities, which he calls 'possible worlds'. These are maximally large physical objects of which all other physical objects (in that reality) are a part. The physical objects of each alternative reality are related to each

other by these spatio-temporal predicates, but each alternative reality is spatio-temporally isolated from the others. These alternative realities have two important roles. The first is to help define properties and propositions. A property *P* is defined to be a (set-theoretic) function which maps each world *w* to a set of individuals at *w* (intuitively, those which exemplify *P* at *w*). In a similar way, Lewis defines propositions to be functions from worlds to truth values (truth values may be regarded as two specially designated set-theoretic objects). The second role these alternative realities play is to ground the modal facts that are true at our world. However, since individuals are world-bound (i.e., can appear only in one world), the truth of these modal facts requires Lewis to appeal to a counterpart relation that holds among individuals (in different worlds) that bear an intimate similarity to each other. For example, the reason Reagan might have had blond hair is that there is a possible world containing a counterpart of Reagan who has blond hair at that world.

This idea is one of two that distinguishes Lewis from the third group of category 2. philosophers, which includes Robert Stalnaker, Saul Kripke, Richard Montague, and Max Cresswell. These philosophers also reconstruct properties (propositions) in terms of set-theoretic functions from worlds to sets of individuals (truth values). But not only do they take the domain of possible worlds to be a primitive domain of quantification (unlike Lewis, who appears to define worlds), they also allow individuals to appear at more than one world. For these philosophers, the reason Reagan might have had blond hair is that there is a possible world in which Reagan himself appears and in which he has blond hair. Of course, there will be objects that exist at other worlds though not at ours, and most of the philosophers in this group quantify over these possible individuals.

A central problem faced by category 2. philosophers is that the reconstruction of properties (and propositions) in terms of extensional, set-theoretic entities results in the identification of many properties (and propositions) that we intuitively take to be distinct. Intuitively, the property *shaves just those who do not shave themselves* is distinct from the property *loves just those who do not love themselves*, but on pain of contradiction, nothing could ever exemplify either of these two properties. But when reconstructed as functions from worlds to sets of individuals, these two properties are identified, since they both get reconstructed as the same function, namely, that function which maps each world to the null set.

Category 3. Convinced that this problem requires one to take at least some non-extensional entities as basic, philosophers in this category typically appeal to universals such as properties, relations, and propositions, as opposed to sets. Though some philosophers in this category take sets as basic as well, those that do can usually be distinguished from the members of the previous category by the fact that they regard ordinary, non-mathematical predicates of language as signifying relations and properties rather than sets.

There are three basic groups of category 3. philosophers. The first consists of philosophers who organize the realm of properties, relations, and propositions in an explicit and systematic way. Bertrand Russell and A. N. Whitehead, Alonzo Church, Nino Cocchiarella, George Bealer, Alan McMichael, Christopher Menzel, and Raymond Turner offer mathematically precise theories of relations. Russell and Whitehead (in their *Principia Mathematica*, 1911), and Church (in his "On the logic of sense and denotation", 1951), are distinguished by the fact that they develop type hierarchies. In its simplest form, a type hierarchy begins with at least one basic type (the type *i* for individuals) and a method of constructing relational types. For example, type $\langle i,i \rangle$ is the type for 2-place relations between individuals; type $\langle\rangle$ is the type for propositions (which have no arguments); and type $\langle i,\langle\rangle \rangle$ is the type for 2-place relations between individuals and propositions, and so forth. By way of contrast, Cocchiarella, Bealer, Menzel, and Turner have developed type-free theories. These theories essentially treat universals as a kind of individual, for not only may untyped predicate constants and variables (or nominalized correlates thereof)

stand in argument position in a formula, but predicate variables in such position may be bound by first-order quantifiers ranging over ordinary individuals. It should be mentioned that few of the philosophers in this group offer an analysis of modal statements.

The second group of philosophers in category 3. are somewhat less systematic – they do not offer unified theories of relations and propositions. However, the work of the early Ludwig Wittgenstein (*Tractatus Logico-Philosophicus*, 1922), Gustav Bergmann, Roderick M. Chisholm, and Alvin Plantinga stands out primarily because of these authors' global metaphysical outlook and because they have made an attempt to answer a wide range of metaphysical questions using a minimum number of primitive notions. Chisholm and Plantinga both appeal to relations and states of affairs in their investigations into the nature of modality, actuality, identity, the self, God, and causal agency. Both philosophers take modal idioms to be primitive and define possible worlds to be possible states of affairs p which are such that for every state of affairs q, either p entails q or p entails *not-q*. In connection with the work of Chisholm and Plantinga, we should mention that of John Pollock and Robert Adams. The latter two hold views related to those of the former except that they both quantify over sets as well as universals. Adams, for example, attempts to understand talk about possible worlds in terms of 'world-stories', which are defined to be sets of propositions S such that for every proposition p, either $p \in S$ or *not-p* $\in S$ and such that it is possible that all of the members of S be true together.

The final group in category 3. comprises the co-authors Jon Barwise and John Perry. Their perspective on language, 'situation semantics', is based on the metaphysical view that situations, individuals, and relations are basic (with individuals and relations being uniformities across situations). Though this bears some similarity to the ideas of Chisholm and Plantinga, the approaches differ in two basic ways. First, whereas Chisholm and Plantinga believe that the negation of a state of affairs is also a state of affairs, Barwise and Perry conceive of situations as concrete pieces of reality, and hence not the kind of thing that could have a negation. Second, Barwise and Perry have more systematic ideas about the connections between the domain of relations and the domain of situations. It should be mentioned that in their book of 1983, Barwise and Perry provide a model of their metaphysical views in which sets are utilized. But this model is not to be confused with what they are trying to model, and one should not be misled by this apparent commitment to sets.

Though all of the philosophers in category 3. are committed to properties and relations of some sort, there is little consensus regarding the identity conditions that govern these universals. We should also point out that, with the possible exception of Church, the explanation of certain intentional idioms and intensional contexts often seems somewhat problematic for philosophers in this category.

Category 4. It is primarily for the purpose of analysing intentional idioms and intensional contexts that the philosophers of this final category quantify over other primitive domains besides individuals and universals. For example, Kit Fine has developed a theory of 'arbitrary' objects, which are used primarily to explain the directed (intentional) nature of our mental states, as well as the intensional language that we use when we reason about an arbitrarily chosen member of a class of things in order to conclude something general about the entire class. Terence Parsons has produced rather convincing arguments for quantifying over non-existent objects, objects which seem to play an intimate role in fiction, mythology, and dreams. To rebut the classic objections to such objects in a logically precise way, Parsons develops a coherent and consistent formal theory of non-existent objects, based on the ideas of Alexius Meinong (in his article "Über Gegenstandstheorie", 1904) and his student Ernst Mally. Hector-Neri Castañeda has developed a theory of 'guises', not only to analyse talk about non-existent objects, but also to explain puzzles about intentional contexts raised by Gottlob Frege in his seminal article "On sense and reference" (1892). On Castañeda's theory, individuals do not exemplify their properties, but are rather constituted out of sets of properties

using a special operation that captures a new form of predication.

Finally, the present author also follows a suggestion of Mally. He axiomatizes a domain of abstract objects that are individuated by the properties they *encode*. An object that encodes a property is determined by that property without necessarily exemplifying it, just as the content of a mental image of a man with a beard is determined by the property of having a beard without exemplifying this property. The properties encoded by an abstract object are even more crucial to its identity than the properties it exemplifies necessarily. For example, the number 1 is identified as an abstract object that encodes such properties as being greater than zero, being less than 2, and so forth, while it necessarily exemplifies such properties as being abstract and not being located in space. In this manner, the present author identifies, among these abstract objects, such philosophical entities as monads, possible worlds, fictional characters, and mathematical objects. For example, the monad of an object y is that abstract object x which encodes just the properties y exemplifies. A possible world is an abstract object x such that it is possible that x encodes just the properties of the form *being such that p* constructed out of true propositions p. Finally, these objects are used to explain puzzles about language that arise in connection with intensional contexts. An axiomatized modal theory of properties, relations, and propositions underlies the theory of abstract objects.

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EDWARD N. ZALTA

Mind

The expression 'the mind' has a number of quite different uses and this fact has led to some confusion in recent discussions of the relations between 'the mind' and the body. We may distinguish at least five such uses and therefore at least five senses of 'the mind–body problem'.

1. One may use the term 'mind', as René Descartes had used the terms '*mens*' and '*esprit*,' to refer to whatever has psychological properties – to that which thinks, senses,

believes, desires. In this case, 'mind' would mean the same as 'self' or 'person' and therefore would designate such entities as you and me. If we use 'mind' this way, one form of the mind–body problem would be the philosophical question: What is the relation between persons and their bodies? What is the relation, for example, between me and my body?

It has been suggested in recent years that 'the mind' is related to the body in the way in which the abstract diagram of a computer is related to the hardware which is the computer itself. But this suggestion cannot be true if 'mind' is taken, in the sense just distinguished, to refer to that which *has* psychological properties. For the abstract diagram of a computer is itself a property, an abstract object. But that which has psychological properties – that which senses, thinks, feels, and desires – is an individual thing and not an abstract object.

2. Many have used 'mind' to designate the set of *psychological states and properties* that one has. The 'mind–body problem', for one who uses 'the mind' this way, concerns what was once called 'psychophysics' – the study of the relations that obtain between psychological states and properties, on the one hand, and physical states and properties, on the other. The concern is with such questions as: Is each psychological property *dependent* upon some physical property or upon some set of physical properties? Is each psychological property *identical* with some physical property? Most contemporary discussions that purport to be about 'the mind–body problem' are primarily concerned with such questions as these.

But even among those who are concerned with the psychophysical problem, as here described, there are differences in the use of 'mind' – arising from different uses of the term 'psychological'. Often one's *psychological* states and properties are identified with one's *conscious* states and properties – such states and properties as sensing, feeling, judging, and other types of thinking. But at other times 'psychological' is used, somewhat differently, to refer to one's psychological *capacities* – to the totality of dispositions and complexes that a person has. The term is being used in this way when one says, 'That person has a good mind', meaning that the person is intelligent.

3. Many have used 'the mind' to refer to what might be called the *reification* or *substantialization* of one's total conscious state; in this case the total state is thought of as being an individual thing, just as the body is an individual thing. One then speaks of the problem of how *psychological substances* are related to *physical substances*. This reification of conscious states is the view that William James had called 'The Mind–Stuff theory' (1910, Chapter 6). But the 'mind–body problem' that thus results from reifying conscious states is no problem for those who refuse to reify such states. And indeed there seems to be no justification whatever for thus construing properties and states as concrete individual things.

4. One also speaks of a person's 'mind' as being *that by means* of which the person thinks. In this case, the term 'mind' *does* designate an individual thing and one that is physical. For 'that by means of which one thinks' is quite obviously the brain – or at least something that includes a part of the brain. If we thus use 'mind' to mean that by means of which one thinks, then what we would call an 'investigation of the mind' would be a neurophysiological investigation of the brain. And the expression 'mind–body problem' would refer to certain questions of neurophysiology. Answers to these neurological questions do not, as such, give us a solution to the 'mind–body problem', where this expression is interpreted in accordance with the *first* sense of 'mind' distinguished above. Many have assumed – quite obviously incorrectly – that from the fact that one thinks *by means of* the brain, it follows logically that it is *the brain* that thinks. We walk by means of our feet, but our feet do not walk in the sense that we do (if they did, then *they* would have feet).

5. The term 'mind' is sometimes used to designate a *simple non-material substance*, an individual thing of a non-material nature. Bernard Bolzano and Franz Brentano assume that the bearers of psychological properties are substances of this sort. The plausibility of this conception depends upon two philosophical assumptions:

a. that there are 'bearers of psychological properties', i.e., things that *have* such properties, and
b. that such bearers cannot be physical substances.

It would seem, then, that the distinctive *philosophical* problems that 'the mind–body problem' involves are the following three.

1. Do psychological properties have bearers?
2. Are psychological properties identical with physical properties?
3. What is the relation between a person and the person's body?

1. Do Psychological Properties have Bearers? Consider any conscious property – say, sensing, judging, wondering, wishing, or hoping. What kinds of thing could *have* such a property? If we can grasp the nature of such properties, and it is quite clear that we can, then we can see that they are properties that can be exemplified only by *individual things*. Judging, wondering, wishing, hoping cannot possibly be properties of *states* of things, or of *processes*. And they cannot be properties of *abstract objects* – of such things as properties, numbers, and relations. *You* can hope for rain, but no state or process or number or property or relation can hope for rain.

In other words, the fact that a certain psychological property is exemplified – the fact, say, that the property of hoping for rain is exemplified – logically implies that there is an *individual substance* that has that property. This is a fact about the property itself: the property of hoping for rain is necessarily such that the only things that can have it are individual things. And analogously for other psychological properties.

Why would one suppose that this is *not* the case?

Some have thought that the concept of an *individual thing*, or *individual substance*, is superfluous and that it may be replaced by the concept of a 'bundle of properties'. The concept of a 'bundle of properties' is thought to remove the need for supposing that there are things that are 'bearers' of properties. According to 'the bundle theorist', if we interpret his statements literally, *no* properties have bearers; that is to say, there are no things that *have* properties. But it is somewhat difficult to formulate the bundle theory coherently.

No one has ever suggested a way of *reducing* statements that are ostensibly about individual things to statements that refer to bundles of properties. Nor has anyone even suggested a way of deciding just *what* bundle of properties is to do duty for any particular individual thing. Indeed, it would seem to be impossible to do this without making clandestine use of the concept of an individual thing. (One would not say, 'The bundle of properties that constitutes *that* thing is just that set of properties that the thing happens to have'. For such a statement would be circular.)

And there are still other problems.

What of properties themselves? Consider the property *being green*. It, too, is a thing that *has* properties. Thus it has the following properties among others: being a 1-place property; being necessarily such that it can be exemplified only if the property of being coloured is exemplified. Should we say, then, that any given property is a superfluous entity that may be replaced by the bundle of *its* properties? If there is no need to distinguish an individual thing from the bundle of its properties, then why must we distinguish a property from the bundle of *its* properties? But if we do *not* distinguish a property from the bundle of its properties, then shall we say that a first-order property (a property of individual things) is merely a bundle of second-order properties (of properties of first-order properties)? And then shall we go on to say that third-order properties are merely bundles of second-order properties, . . . and so on, *ad indefinitum*? What becomes, then, of our ontology?

2. Are Psychological Properties Identical with Physical Properties? According to the doctrine of 'physicalism', which grew out of deliberations among members of the Vienna Circle, psychological states and/or properties are *identical* with neurophysiological states and/or properties. The doctrine would have some initial plausibility if one could show that there is a uniform correlation between

psychological and neurophysiological properties. The possibility of such correlation has been extensively investigated in the case of those psychological properties that are instances of *sensing* – instances of *having a sensation*. Has it been shown that, for each *sensation*, there is a physiological correlate of that sensation – a physiological situation which obtains if and only if one has the sensation? In the present state of psychophysiological investigation, one cannot provide such a correlation. And even if the existence of such a correlation were to be shown or made probable, this finding would pertain only to one type of psychological property. Our psychological properties also include properties that are *intentional* and not *sensory*. Therefore, if physicalism is true, these properties, too, must have physiological correlates. But what physical phenomenon is the correlate, say, of judging that it rained in Strasburg the day before yesterday? Here there is no clue at all as to what the answer might be.

It has been held that such intentional phenomena might be identified, not with physical *states* or *properties*, but with *dispositions to believe*. But how could an occurrent judgement be identical with a disposition to believe? One answer, put somewhat crudely, may be suggested by this biconditional:

> You judge that it rained the day before yesterday in Strasburg, if and only if, you would respond affirmatively to the question 'Did it rain the day before yesterday in Strasburg?'

But such an answer needs further qualification. For the biconditional we have formulated would be false if – what is logically possible – you do *not* judge that it rained in Strasburg but you want others to believe that you *do* make such a judgement. Or the answer would be false if you do make such a judgement but so misunderstand the language of the one who is questioning you that you answer the question negatively.

Can we find suitable qualifications, then, to add to the biconditional? The difficulty is that the qualifications we must add to deal with such examples will refer to *other* intentional phenomena – for example, to the things that you desire or do not desire, to what you believe or do not believe, to what you perceive and think you perceive, and to what you remember and think you remember. A theory consisting of such intentionally qualified biconditionals could hardly be said to reduce psychological phenomena to dispositions to believe – since the relevant qualifications can be formulated only by reference to other psychological phenomena.

Other 'physicalistic' programmes have been suggested. Perhaps the judging about Strasburg is identical with one type of physiological phenomenon when it occurs today and with quite a different type of physiological phenomenon when it occurs tomorrow. Or perhaps the relation of identity holds, not between particular states and/or properties, but between the entire psychological state that one finds oneself in at any given time and some physiological state that one is in at that time. It would be difficult to show that such a view is false. And it would be difficult to show that such a view is true.

But the most serious difficulty with the psychophysical identity thesis is considerably more simple than those so far considered. Let us consider some particular psychophysical identity statement – the statement, say, that thinking about unicorns is the same thing as to have Q fibres that vibrate in manner N. One cannot *understand* such a statement, of course, unless one can grasp or conceive the property or properties that are referred to (and let us pretend that we know what it is to have Q fibres and what it is to have them vibrate in manner N). To the extent that we *can* understand the statement in question, we can *see* that the two properties referred to are not the same property – just as we can *see* that the property of believing that all men are mortal is different from that of wondering whether there is life in outer space. It has been held, not implausibly, that to deny the validity of such rational insights is to undermine the possibility of every type of reasoning.

3. What is the Relation between a Person and his Body? The question may be put more briefly as: 'What is the relation between *me* and my body?'

There are two broad possibilities: either I am identical with my body or I am not identical with it. If I am *not* identical with my body, then once again there are two possibilities. Either:

1. I am identical with something that includes a part of my body.
2. I am not identical with anything that includes a part of my body.

The first possibility is suggested by Pierre Gassendi in his Objections to René Descartes's *Second Meditation*. He suggests that Descartes had not sufficiently considered the possibility that he, Descartes, might in fact be a very subtile wind or spirit spread out through the members of his body. Then, Gassendi asks, why couldn't we say that you "see with the eye, hear with the ear, think with the brain, and thus exercise all the functions that are commonly attributed to you"? It would be difficult, of course, to say *which* proper part of my body is the one that is identical with me. But the view that *some* such bodily part is identical with me is difficult to refute – provided it is carefully formulated.

If I am not identical with anything that includes a part of my body, what kind of a thing am I?

Could I be a 'spiritual substance'? If we take 'spiritual substance' to mean the same as that substantial sense of 'mind' that is employed by those who accept 'the mind–stuff theory', then, as we have seen, it is problematic whether there *is* such an entity.

The remaining possibility is a traditional view, defended by Augustine, Leibniz, and many others. It is the view according to which I am a simple substance (or 'monad'). The most thoroughgoing defence of this view may be found in Bernard Bolzano (1838, p. 101).

See also: **Mind–Body**

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Mind–Body

The mind–body problem is perhaps the most discussed and most difficult problem in all of metaphysics. The problem is one of articulating an account of mind and body (especially the former) that does justice to both pretheoretic and scientific insight. In this century it has sometimes been complained that there is no real problem here, that the difficulties that appear to plague our understanding of the mind–body relationship are mere reflections of linguistic confusion. But the problem refuses to be dismissed; it continues to arise in a variety of contexts: in the foundations of cognitive science, in the philosophy of language, in action theory, and, of course, in philosophy of mind and metaphysics. Given the materialistic bent of contemporary analytic theory, I shall focus on materialistic conceptions of mind and the mind–body relationship. I shall begin, however, with a brief word on the dualist alternative.

Dualism. The world, according to the dualist, contains two basic, irreducibly different, kinds of entity: there are physical entities (e.g., organic bodies), and then there are mental entities – minds and their mental contents (thoughts, pains, and the like). The mental and the physical are conceived of as being radically different in character (though no one has produced an adequate criterion for either); the mental, for example, is supposed to lack the spatial extension characteristic of the physical. There are numerous variations on this common dualist theme: some (notably, René Descartes) claim that there are two kinds of substance, while others opt only for two kinds of qualities. Some hold that the mental and the physical causally

interact, while others are willing to settle for harmony. Though dualism is usually cloaked in the mantle of common sense, it has not proven attractive to most analytic philosophers. The reasons are many: there are, for example, problems with all versions of mind–body interaction, and there are hordes of epistemological difficulties. The primary reason for the waning of dualism is, however, something less tangible: dualism does not accord well with the scientific perspective; it is difficult to envision any integration of the dualist ontology and explanatory model into the scientific scheme of things. Consequently, dualism is summarily dismissed by many as a lingering remnant of a pre-scientific world view.

Materialism. By way of contrast, the materialist conceives of the universe and everything in it as being ultimately physical in character. Materialists, with the exception of eliminativists, grant that there are indeed mental states and events, but, they insist, these must ultimately be understood from a physical perspective. Materialism, which dominates the contemporary analytic scene, may be broken into three large categories: (1) eliminative materialism, (2) reductive materialism, and (3) non-reductive materialism.

1. *Eliminative materialism.* Most materialists view their task as one of offering a physically adequate account of the mental – explaining how physical systems warrant mentalistic characterizations in the light of this or that physical property. The eliminative materialist goes one step further and denies that there are any mental states. He rejects not only dualism, but the mental itself. Just as the scientific inventory of what there is does not include witches, so, he claims, it will not include mental states either. Bogus mentalistic explanations will be replaced by scientific neurological explanations (see Churchland 1981). This is an extreme position, and while future development might conceivably bear it out, there is, at the moment, no reason to think it will.

2. *Reductive materialism.* Reductive accounts come in a variety of forms. They have as a common goal the provision of non-mentalistic (i.e. reductive) conditions for mental states, but they differ in the choice of reductive conditions. We shall confine our attention to three kinds of reductionism which have achieved special prominence: (a) philosophical behaviourism, (b) type/type identity theory, and (c) functionalism.

(a) *Philosophical behaviourism.* This theory identifies mental states with dispositions to behaviour. So, for example, one might on this approach, identify being in pain with being disposed to wince, groan, cry out, etc. This is, of course, an over-simplification; in reality the reductions were to complex, multitracked dispositions, to dispositions constrained by all kinds of *ceteris paribus* clauses. This kind of account, which drew much of its inspiration from positivistic epistemology, was popular in the 1950s and 1960s (see Ryle, *The Concept of Mind*, 1949), but it has now largely been eclipsed by functionalism.

Of the many objections lodged against behaviourism, one was particularly decisive: the programme simply ignored the essential interplay between mental states. A mental state, such as the belief that it is about to rain, does not by itself dispose the subject to any specific behaviour; it does so only in conjunction with further mental states (e.g. the desire not to get wet). The behaviourist dream of reducing mental states one by one to complex behavioural dispositions was thus doomed from the outset.

(b) *Type/type identity theory.* The identity theorist identifies the mind and the brain; being in a given mental state, e.g. pain, is, he claims, no more and no less than being in some particular neurophysiological state (see Armstrong 1968). The identifier advances his claim as an empirical hypothesis, and he looks to future development in the brain sciences to provide the specific identity conditions (to tell us what kinds of neurophysiological states are identical to what kinds of mental states).

This, however, has not come to pass. Indeed, given the diversity of physical organisms, there is now widespread agreement that any physiological taxonomy is likely to be too fine grained to do justice to the mental; sameness of mentality seems to be quite compatible with physiological diversity. And identity theory, like behaviourism, has now largely been replaced by functionalism.

(c) *Functionalism.* Functionalists individuate mental states in terms of the characteristic causal roles they supposedly play in mediating between sensory input and behavioural output; they defend the following kind of reductive schema:

> *F*: a subject x is in mental state M_i if and only if x is in a state that is causally linked (in some specific way, R) to specific inputs $I_1 \ldots I_n$, to other internal states $S_1 \ldots S_m$, and to specific outputs $O_1 \ldots O_k$.

So, to over-simplify again, pain might be defined as the state that is caused by tissue damage; that in turn causes the subject to feel self-pity, to desire comfort, to cry out if one thinks help is at hand, and so on. What is distinctive of pain is the role it plays in our 'inner life'. Individual functionalists differ greatly in detail, but they fall into two main camps: the *a priori* functionalist (e.g. David Lewis) defends this kind of analysis on conceptual grounds, as explicating the meaning of terms such as 'pain'; the *a posteriori* functionalist (e.g. Hilary Putnam) defends the analysis on empirical grounds as a plausible hypothesis regarding the nature of mental states (often drawing on the analogy many see between mental states and the functionally specified states of automata).

Functionalism, especially of the empirical kind, is currently the most widely favoured theory of mind. This kind of account, it is claimed, reflects the conception of mind dominant in current cognitive science and it extracts what is intuitive in both identity theory and behaviourism without inheriting the defects of either. Like behaviourism it recognizes the close link between mental states and behaviour; but, unlike behaviourism, it does not attempt to link mental states, taken one at a time, to behaviour. It explicitly takes account of the fact that a given mental state M_i will tend to produce a given output O_j only in conjunction with further internal states. (The fact that mental terms figure on the right-hand side of the biconditional (*F*) does not undermine the reductive character of the thesis; they can be eliminated using 'Ramsification' (see Lewis 1972)). Functionalism is like identity theory in that it construes mental states as genuine internal states that figure in the causal genesis of behaviour; but, unlike identity theory, it does not tie sameness of mental state to sameness of brain state; different brain states can play the same functional role in different individuals.

Despite its popularity, functionalism, of both kinds, is faced with severe problems. A number of authors (e.g. N. Block) have argued persuasively that such accounts fail to do justice to the qualitative character of mental states such as pain – that the 'painful' character of such a state is essential to the state, and this is something entirely apart from the role the state happens to play. (This intuitive difficulty is reflected in the question: Could you make a computer that felt pain?) But the problems are not confined to qualitative states; the functionalist treatment of intentional states (states such as belief which are partly defined in terms of content) is also plagued with difficulties. To list just a few of the more important:

(i) On such accounts the content of a state such as belief is determined by the state's role and this makes for difficulties in accommodating error. In many cases of error one wants to say that the subject employs a belief in ways that ill accord with its content. But how can one say this if the very content is determined by the state's role? In addition, such functionalist accounts are excessively holistic; changing one's mind on anything (changing the role of some state or other) will affect all the other interdefined states, thereby altering the content of all of one's functionally defined states (e.g., beliefs).

(ii) If the functionalist account is to be truly reductive, the inputs and outputs must be specified in some non-intentional terminology. (This, for example, rules out output characterizations of the form, '–said that such and such'). But when one attempts to carry this out the output characterizations appear to be too abstract or too restrictive; the resulting functional characterization is satisfied by creatures which apparently lack minds or it denies mentality to creatures that apparently have it (see Block 1980).

(iii) Functionalism, like other reductive accounts, is clearly threatened by Twin Earth examples (see below).

3. *Non-reductive-materialist constraints on the mental.* In addition to reductive accounts, one also finds in the literature frequent mention of two sorts of constraints which supposedly should be satisfied even in the absence of any reduction.

(i) Token/token identity thesis. The token identifier, for example Donald Davidson, claims that each instance of a mental state is identical to an instance of a physical state or event (even in the absence of any general reduction). This thesis is usually seen as an expression of the materialist intuition that ultimately everything *is* physical.

(ii) Psychological supervenience. A variety of claims go by this title, but, crudely put, the central idea is this: if two individuals are physical replicas (particle for particle identical throughout their lives) then they are psychological replicas – they agree in all their mental states. This thesis (which needs a variety of refinements if it is to be at all plausible) is even weaker than the token/token identity thesis; the physical can constrain the mental in this way even in the absence of identities. Such supervenience principles are today defended on methodological grounds and as expressions of the materialist intuition that the physical *determines* the mental (see Fodor 1981).

These two. non-reductive constraints appear quite weak, and, for many, abandoning either is tantamount to abandoning materialism. Weak or not, recent investigation of Twin Earth examples suggest that they are untenable. The typical Twin Earth example presents us with two individuals who are, by hypothesis, particle for particle alike; they have the same physical inputs, are disposed to the same physical behaviours; and, in particular, let us suppose they are both disposed to utter sincerely: 'Aluminium is used in the manufacture of aircraft'. They are, however, members of linguistic communities which differ in their employment of the word 'aluminium'; one community, we may assume, is like ours, while in the other the word is used to designate what we call 'molybdenum'. Such examples, appropriately filled in, strongly suggest that the two individuals differ in their beliefs; the one believes that aluminium is used in the manufacture of aircraft, while the other believes something quite different (see Burge 1979).

Materialistic intuitions continue to dominate in the analytic tradition, but examples of this kind undermine both the identity and supervenience constraints (plus standard reductive accounts) and they pose a serious challenge for the theorist who attempts to go beyond unarticulated intuition, to undertake the task of 'explaining' the mental from a physical perspective.

See also: **Mind**

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JOSEPH OWENS

Modalities, Ontological

Alethic modalities are modifiers of semantical and logical components of judgements. Their classification obviously depends on the ontology and semantics that is presupposed. Some modalities are theoretical – useful for reasoning; some are practical or pragmatic – useful for action. Taking the first, at least four kinds of alethic theoretical modalities should be distinguished:

1. *A priori*, concerning what can be thought, used to delineate the realm of reason. Examples are *thinkable, understandable, reasonable, controvertible*, etc.

2. Logical, used for collection and comparison: *possible, necessary, contingent*, etc.
3. Metaphysical, concerning facts, what is real or actual: *actual, factual, to be a fact, to be true, making true, making actual*, etc.
4. Ontological, useful for describing the general and basic conditions for some families of objects or complexes. They concern the possibility of what there is, or what is possible; hence they are used for delineation of the most general field we can deal with – the realm of all possibilities – the ontological space. Examples are: *possibility, necessity, contingency*, and *exclusion* taken in the sense of a condition; *compossibility, coexistence*, and *eminent existence* in the sense of Leibniz, *(formal) possibility* in the sense of Ludwig Wittgenstein's *Tractatus; combinable, synthetizable* and *analysable; making possible, making impossible, being ontologically neutral*; and several common philosophical modalities *de re*: *by necessity, essentially, by its very nature*, etc.

The above classification has a clear counterpart in grammar: some modalities, mostly logical but also *a priori* and metaphysical ones, are adjective-like, some – chiefly ontological modalities – are noun-like. On the other hand, the logical modalities are quantifier-like modifiers (what is nowadays clarified by relational semantics).

There is a widely shared temptation to reduce some modalities to other ones, particularly ontological to logical modalities (and *a fortiori* noun- to adjective-modalities). Moreover, where such reduction is difficult or counterintuitive, it is usual to ignore the unmanageable cases.

According to the kind of modalities one prefers, we have several types of modal reductionism: modal apriorism, factualism, etc. The most popular is modal logicism which claims that any alethic modality can and ought to be treated as a logical modality. The extreme version of this position – modal extensionalism (cf. Quine 1953) is the conjunction of two theses: first, that any alethic modality is reducible to logical modality(ies); and second, that any essential use of logical modalities is eliminable, formally expressed as a claim in favour of the eliminability of *de re* modalities by modalities *de dicto*. Extensionalism not only reduces modalities; it also substitutes set-theoretical ontology for any intensional ontology.

Ontological modalities are the key to any non-reductionistic ontology. The most august family thereof is that of Leibniz: *compossibility, compatibility, coexistence*, and *eminent existence*. Leibniz himself was fully aware of the role they play in ontology, warning against the "confusion of possibles for compossibles" (*Philosophical Papers and Letters*, ed. L. E. Loemker, 1969, p. 661).

A very manageable family of ontological modalities consists of: *making possible* (MP), *making impossible* (MI), *being ontologically neutral* (ON), which are introduced to formalize the fundamental ontological connections: attraction, repulsion, and indifference.

They are useful especially for the development of the combination ontology dealing, *inter alia*, with relations *simpler than* or *being in* and *combinable from* (cf. Perzanowski 1989). In addition, they enable us to express the Leibnizian modalities mentioned above.

There are two complementary approaches to the theoretical treatment of these modalities: the axiomatic and the semantic. From the semantic point of view, based on the description of the ontological space, MP is used to express formal conditions of synthesis.

Let $\sigma(x)$ denote the collection of all objects synthetizable from the object x, i.e. objects which can be obtained from the objects connected with x (in the most natural case – from the substance of x), $<$ the relation *simpler than* or *being in*. The basic idea concerning *making possible* can now be expressed by:

$\mathrm{MP}(x,y) \leftrightarrow y \in \sigma(x)$
x makes possible y iff y is synthetizable from x.

The outlined family of ontological modalities enables us to define most of the notions

used in ontology. In particular, using MP we can define:

$\mathrm{Cons}(x) := \mathrm{MP}(x,x)$; x is ontologically *coherent* (*consistent*) iff x makes itself possible.

$\mathrm{C}(x,y) := \mathrm{MP}(x,y) \,\&\, \mathrm{MP}(y,x)$; x and y are *compossible* iff each of them makes possible the other.

$\mathrm{E}(x,y) := \exists z{<}y\ \mathrm{MP}(z,x)$; x *exists eminently* in y iff there is something in y which makes x possible.

$\mathrm{R}(x,y) := \forall z{<}x\ \mathrm{MP}(z,y)$; y is (ontologically) *alternative* to x iff everything in x makes y possible.

The first three notions were used by Leibniz, the last encodes the alternativity relation of the canonical models of relational semantics (cf. Chellas 1980). Using the chosen modalities we can therefore define relational semantics for modal logic, providing it with a solid ontological foundation. Note that the relation R closely connects with Leibniz's notion of eminent existence:

$R(x,y) \rightarrow E(y,x)$
y is alternative to x implies that y eminently exists in x.

The axiomatic approach opens a rich field of research. Most of the axioms answer the basic questions of ontology. For example: Does making possible preserve ontological coherence?

A priori we have three positive answers, each of which yields a suitable axiom of preservation:

$(CR)\quad \mathrm{MP}(x,y) \,\&\, \mathrm{Cons}(x) \rightarrow \mathrm{Cons}(y)$
$(CL)\quad \mathrm{MP}(x,y) \,\&\, \mathrm{Cons}(y) \rightarrow \mathrm{Cons}(x)$
$(C)\quad \mathrm{MP}(x,y) \rightarrow (\mathrm{Cons}(x) \leftrightarrow \mathrm{Cons}(y))$

Is making possible $<$-monotonic? This yields several axioms of (left/right) monotonicity, among others:

$\mathrm{MP}(\uparrow) : \mathrm{MP}(x,y) \,\&\, x{<}z \rightarrow \mathrm{MP}(z,y)$
$\mathrm{MP}(\downarrow) : \mathrm{MP}(x,y) \,\&\, z{<}y \rightarrow \mathrm{MP}(x,z)$,

and so on.

Is the ontological universe uniform? I.e., does it include only coherent objects? Only compossible objects?

Again, positive answers to such questions yield the following axioms:

(Ucons) $\forall x\ \mathrm{Cons}(x)$
(UC) $\forall x,y\ \mathrm{C}(x,y)$

What interconnections hold between basic modalities?

Again, this yields a range of different axioms, for example:

The axiom of ontological trichotomy:
(OT) $\forall x,y\ (\mathrm{MP}(x,y) \vee \mathrm{MI}(x,y) \vee \mathrm{ON}(x,y))$

The axiom of full modalization:
(FM) $\forall x,y\ \neg\mathrm{ON}(x,y)$

The contrary axiom of ontological extensionality:

(OE) $\forall x,y\ \ \mathrm{ON}(x,y)$

The axiom of ontological excluded middle, i.e., the ontological consistency axiom:
(OC) $\forall x,y\ (\mathrm{MP}(x,y) \leftrightarrow \neg\mathrm{MI}(x,y))$.

By taking appropriate families of axioms a wide range of different ontological theories may be defined.

Finally, notice that the above picture, following Leibniz, is chiefly based on the positive ontological modality *making possible* (MP). If instead we prefer the negative modality *making impossible* (MI) this would yield a Hegelian path in ontology.

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JERZY PERZANOWSKI

Modal Logic

In what sense does a kind of logic have a metaphysics? First-order logic might be said to be committed to an ontology of individuals, in that a domain of individuals is required for evaluation of first-order sentences, but the individuals can be any kind of thing and someone could say that they use first-order notation merely as a *façon de parler*. But in modal logic, metaphysical commitments may be more substantial.

The view that they are is most famously associated with W. V. O. Quine (e.g. Quine 1953, 1961). The standard approach to evaluating sentences of quantified modal logic (QML) is by possible-worlds semantics (PW semantics), as canonically formulated in Saul Kripke (1963). A set of possible worlds is specified and each world is associated with

1. a domain of individuals, and
2. an extension for each predicate symbol of the language.

The result is a *model* for QML, truth-at-a-world-in-a-model is recursively defined for sentences of the language, and notions of validity and logical consequence are then forthcoming. As a result of this procedure, PW semantics endows each sentence with a PW truth-condition. For instance, '$(\exists x)\Box Fx$' is assigned the PW truth-condition 'there exists an object which is F at every world'. And it is here that Quine's objections begin.

In an early paper, Quine argued that we cannot make sense of the subformula '$\Box Fx$', since we can only say that x is necessarily F if we adopt "an invidious attitude towards certain ways of uniquely specifying x . . . and favour other ways . . . as somehow better revealing the 'essence' of the object" (1953, p. 155). And Quine does not think this "reversion to Aristotelian essentialism" (loc. cit.) is an example of progress in philosophy. However, it is not clear that the objection can be sustained. An essential property of an object is one without which it could not exist: P is essential to x iff there is no world where x exists and lacks P. And we can see by inspection of PW semantics that there is nothing in this apparatus which makes it a necessary condition of evaluating sentences that some object in the domain of some world be assigned an essential property of any but the most trivial sort (existence, self-identity, and the like). Furthermore, in the recent literature many writers have advanced highly non-trivial essentialist theses and defended them with sophisticated arguments: for example, there is Kripke's view that the origin of an organism is essential to it (Kripke 1972, 1980), Hilary Putnam's that the fundamental physical properties of compounds, elements, and biological species are essential to them (Putnam 1975), David Wiggins's that the biological kind of an organism is essential to it (Wiggins 1980) and Kit Fine's that the membership of a set is essential to it (Fine 1976). So endorsement of Aristotelian essentialism may be nothing to be ashamed of.

More recently Quine has raised a deeper objection to PW semantics. In a PW model, the domains of worlds may overlap, so in any such model there are facts about which things in such-and-such a world are identical to, or distinct from, which things in such-and-such another world. But according to Quine, this notion of transworld identity is not coherent, for:

> . . . our cross-moment identification of bodies turned on continuity of displacement, distortion and chemical change. These considerations cannot be extended across worlds, because you can change anything to anything by easy stages through some connecting series of possible worlds (Quine 1976, p. 861);

the problem is sometimes called 'Chisholm's Paradox', after R. M. Chisholm (1968). But this objection can also be contested. Say that a sentence is *de re* iff either (a) it contains a proper name within the scope of a modal operator, as in '$\Box$(if Jones exists, then Jones is human)', or else (b) it contains a variable within the scope of a modal operator bound by a quantifier not within that operator's scope, as in '$(\exists x)\Box$(if x exists, then x is human)'; all other sentences are said to be *de dicto*. Then it can be shown that the facts about transworld identity are germane only to the evaluation of *de re* sentences (Fine 1978, pp. 143–5). We might then say that *de re* sentences are meaningless, but retain PW

semantics by employing D. Kaplan's distinction between the artefacts of, and representational features of, a model: the overlaps between domains of worlds would be decreed to be an artefact of the model (Kaplan 1975) as opposed to a representation of a genuine aspect of modal reality.

Perhaps it is rather Draconian to say that *de re* sentences are strictly meaningless. Instead, we could try to endow them with meaning by finding assumptions on which, for each *de re* sentence, there is a *de dicto* sentence to which it is equivalent. However, assumptions required to guarantee that a *de dicto* equivalent is always available are rather extreme (Fine 1978, pp. 299–301) and the meaning thus bestowed on a *de re* sentence does not correspond to any natural interpretation of it. Why can we not take such a sentence as '□(if Jones exists, then Jones is human)' at face value? Some reply must be made to Quine's objections, of course, but there appear to be at least three strategies one could pursue. First, it might be argued that transworld identity is a primitive relation which is not fully analysable (Kaplan 1975). Or one might reformulate PW semantics in such a way that it is some other cross-world relation which is appealed to in evaluating *de re* sentences, as in David Lewis (1968). Or finally, one might pursue the method of *individual essences*. An individual essence of x is any set of properties each of which is essential to x and such that necessarily, no other object has or could have had them all. If none of the essential properties of x is trivially essential to x, then an individual essence for x provides substantial necessary and sufficient conditions for an object at a world to be identical to x. And if the properties in the essence can be imprecise, such as the property of standing in relation $\mathbb{R}$ to *a significant majority* of $x_1 \ldots x_n$, the slippery slope of Chisholm's Paradox can be avoided (Salmon 1981, Forbes 1985, Chapters 5–7).

The interpretative apparatus of PW semantics requires not merely domains of worlds which may overlap, but the reading of □ and ◇ as quantifiers over worlds. Do we really wish to be committed to the existence of a possible world just on the grounds that some propositions are contingently true? On the other hand, if we do not take the reading of □ and ◇ as '*there exists* a possible world w such that $P(w)$' seriously, how can we hope to explain why '$\Diamond(P\&Q)$' does not follow from '$\Diamond P\&\Diamond Q$' in terms of the reason why '$(\exists x)(Fx \,\&\, Gx)$' does not follow from '$(\exists x)Fx \,\&\, (\exists x)Gx$'?

There are two broad approaches to this question, the modalist and the anti-modalist, each of which subdivides. Modalism is the view that the modal operators are primitive, not disguised quantifiers, while anti-modalism regards the quantifier reading as a correct *analysis*. Anti-modalists include Alvin Plantinga (1974), R. Stalnaker (1984), and David Lewis (1986), each of whom thinks of modal operators as quantifiers over entities of a certain sort. But the anti-modalists divide over the status of the entities: some are *actualists*, others *possibilists*. Roughly, a possibilist is one who holds that non-actual worlds and their contents exist in as robust a sense as the actual world and its contents, much as other places and the things located at them exist in as robust a sense as *this* place and the things located *here*. The combination of possibilism and anti-modalism is defended most trenchantly in Lewis (1986). By contrast, an actualist regards actual existence as the basic notion, and possible existence as a modal modification of it. Thus an actualist who is also an anti-modalist regards □ and ◇ as quantifiers over entities which actually exist, such as maximal states of affairs (Plantinga 1974) or ways for things to be (Stalnaker 1984); on this view, the actual world has the special status of being the maximal state which *obtains*, or the way things *are*. On either view, the fact that the interpretative apparatus of PW semantics construes □ and ◇ as quantifiers is not problematic.

But it is *prima facie* problematic for the modalist. Modalists may also be divided into two camps as actualists or possibilists. The viewpoint of A. N. Prior and Fine (1976) and C. Peacocke (1978) is modalist and actualist; this is reflected by the treatment of the objectual existential quantifier in the modal language as having for its range at any world exactly the things which exist at that world. By contrast, someone who combined modal-

ism with possibilism would let the range of the objectual existential quantifier at a world be the union of the domains of all the worlds (this difference in approach would include the difference in attitude to the existence of non-actual worlds so long as we allowed each world, and no other, to appear in its own domain). For such a possibilist, there *are* things which do not actually exist. But on both approaches, PW semantics is problematic in so far as it construes the modal operators as quantifiers, since a modalist regards such construal as unfaithful to the literal meanings of the quantifiers. He or she must then say that the PW truth-condition of a modal sentence is merely a *façon de parler*. But in that case, how does PW semantics acquire its authority to settle the facts about logical consequence? In Fine (1981) and Forbes (1988) PW truth-conditions are themselves understood by translation into another modal language. Does this preclude appeal to the first-order structure of the PW truth-conditions as the ultimate arbiter of logical matters, or is the verdict delivered by PW semantics itself dependent on a different approach to the semantics of modal logic? These questions bring us to the boundary of a rich and relatively unexplored area.

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GRAEME FORBES

Modes

Broadly speaking, 'mode' indicates a way of being. Augustine was the first to give an important philosophical meaning to '*modus*'. He uses it to represent something like the limit or measure of a created, finite being, i.e., limited according to space, time, degree of being, knowledge, etc. He applies this notion in a broad way to various disciplines, including physics and theology. Augustine uses 'mode' in ontology to represent the limit which determines a being to its substantial form. Without it, a being could not be determined to its form (*De natura boni*, Chapter 41).

Thomas Aquinas, while at times employing the Augustinian notion, sometimes uses 'mode' to denote the different grades into which being can be sorted hierarchically according to its degree of privation, negation, or being in another. He lists four modes. The lowest mode contains privation and negation, which do not exist as such, but can be used as grammatically entitative. The second mode includes the incomplete acts of generation, corruption, and motion. The third mode contains the being in another of features (i.e., the white in this wall). The final, and highest mode of being, is the being in itself of a substance. (*In duodecim libros metaphysicorum Aristotelis expositio*, Book IV, 1, Chapter 540–43.)

Augustine's conception of 'mode' continued in use with slight modifications throughout the Middle Ages. Beginning with Giles of Rome (*c.* 1243–1316), however, the more usual ontological interpretation begins to evolve. In dealing with the distinction between a nature and a *suppositum*, Giles posits modes "as the principle of entity, and as the principle of the union of categories" (cf. Trapp 1935).

Francisco Suárez (1548–1617) sharpens Giles's notion in his *Disputationes metaphysicae* (VII, Sec. I, Chapter 17): "I posit in created things, besides their entities... certain real modes, which are something positive, and which through themselves modify their entities". Suárez offers what is perhaps the most extensive systematization of modes. For example, the accidental role of quantity, as contrasted with substantial modes, is just the inherence which joins the quantity with the substance. With his modal theory, Suárez deals with an anticipation of the Bradley Problem: if an accident inheres in substance by the accident of inherence, what causes the accident of inherence to inhere? Suárez solves this by positing inherence as a mode rather than as an entity which requires further inherence. Another example of a mode is the substantial one which unites form with matter.

Thus, in the scholastic tradition in general, modes appear as an extension of the substance-accident theory, parallel to the extension of predication theory accomplished by means of the theory of second intentions and higher predicates (cf. Angelelli 1967).

Contrary to Suárez, René Descartes virtually conflates the notions of 'mode' and 'accident'. 'Mode', along with 'quality', etc. is used by Descartes to do the work done by the scholastic 'accident'. We understand by *modes*, he says:

> exactly the same thing as we understand elsewhere by *attributes* or *qualities*. But when we consider that the substance is affected or altered by these things, we call them *modes*; when the kind of this substance can be named from this alteration, we call them *qualities*; and finally, when we more generally consider these only as being inherent in a substance... we call them *attributes* (*Principles of Philosophy*, Part 1, Chapter 56).

Thus 'mode' becomes, in Descartes, a special kind of accident.

Spinoza, in Part I of the *Ethics*, defines 'mode' in this way: "By *mode*, I mean the modifications of substance, or that which exists in, and is conceived through, something other than itself". Hence in Spinoza's monistic system of substance (God) and its attributes (e.g. thought and extension), there exist modifications (modes) which, again, are divided into infinite and finite. The infinite modes include motion and rest, the infinite intellect, and the eternal laws of nature. Together, these infinite modes constitute the *Natura naturata* (passive aspect of nature). The finite modes are merely particular things, for example bodies. They are mutually interdependent and infinitely interconnected.

John Locke uses 'mode' as follows:

> Modes I call such complex ideas which, however compounded, contain not in them the supposition of subsisting by themselves, but are considered as dependencies on, or affectations of substances (*An Essay Concerning Human Understanding*, Book II, Chapter 12).

He divides modes into simple and mixed. Simple modes "are only variations, or different combinations of the same simple idea, without the mixture of any other". His example includes 'dozen' which is just the notion of twelve units added together. A mixed mode is "compounded of simple ideas of several kinds, put together to make one complex one; – e.g. beauty". Thus Locke identifies a mode as anything which is neither a substance nor a relation. Hence Locke's usage compares with Descartes's, while both contrast with Spinoza's.

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LYNN CATES

Modi Essendi

The *modi essendi* were meant to provide an ontological foundation for grammar. Grammatical rules and relations were no longer to be illustrated via examples from literature, as had been the case with the old grammarians. Rather from the time of the Modistae the grammatical rules were subordinated to the semantic rules and to rules of 'reason'.

Robert Kilwardby (1200–79) is the first grammarian to mention the triad of *modi essendi* (also denoted by him as *modus rei*), *modi intelligendi*, and *modi significandi* that is characteristic of the Modistic grammar. If one examines the role Kilwardby played in the development of speculative grammar, one may conclude that he is most likely to have been the originator of the three *modi*. Their differentiation has been seen as emanating from the statement of Boethius: "The sound expresses by means of the intellect the things which are objects of the intellect" (*Vox per intellectum medietatem subiectas intellectui res manifestat*). This is similar to the theory of Aristotle from *De Interpretatione* I, to the effect that the written and spoken word are not the same for all people; they are only signs for the mental sensation, which are the same for all people. A commentator on Boethius affirms that all spoken communication is based upon three elements: the thing (*res*), the intellect (*intellectus*), with whose help we may perceive the thing, and the sound (*vox*). From each element a *modus* is deduced:

res – modus essendi
intellectus – modus intelligendi
vox – modus significandi.

In order to determine what *modus* implies, we shall have to explain the origin and meaning of the term. We meet it first in the Latin Stoics, who were rediscovered during the lifetime of Peter Helias (fl. *c.* 1140), the predecessor of the Modistae. *Modus* for the Latin Stoics is the Latin translation of the πῶς ἔχον of the Greek Stoics. When considering the function this term had in the Stoic doctrine, we may well render it as 'to behave in a certain way' (*ein Sich-in-gewisser-Weise-verhalten* (Gabler 1987, pp. 41 f.)).

Each thing has a being (*essentia*) and a *modus essendi*, that is a kind and fashion, how it is or exists. Radulphus Brito (died 1320) and Thomas of Erfurt (*c.* 1260–1310), the most representative of the Modistae, understand *modus essendi* as mode of existence. *Modus essendi* is a property of the thing itself (*modus essendi est proprietas rei absolute*), i.e. it is not dependent on anything else.

We cannot put the level of *modus essendi* on a level with the real things. For *figmenta*, too, have a *modus essendi*. As for figments and privations, however, their *modi essendi* are identical with their *modi intelligendi*. These beings are not *entia positiva extra animam* (they are not positive things outside the soul), but only *entia positiva in anima* (positive beings in the soul). In our fantasy, figments are made up of parts deduced from *entia positiva extra animam* (e.g. the chimera, which we imagine with the head of a lion and the tail of a snake).

The level of *modi essendi* is based on the level of the things and their properties. Thomas of Erfurt, for example, speaks emphatically about the properties of individual things. This coincides with the ontological realism then predominant.

The *modus essendi* is not a linguistic category, but an ontological one. The Modistae show that the substances (things) with their properties exist outside language. These properties serve as a base for the division of parts of speech. There exists among the properties a certain order, deriving from the strength of the various *partes orationis* which are either *magis* or *minus principales* (more or less important).

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DARIUS GABLER

Modification

The distinction between determining and modifying predicates, which is at least as old as Kant's *Critique of Pure Reason* and which is clearly stated by Bernard Bolzano (*Theory of Science* I, §§23, 29), was extensively thematized by Franz Brentano and his school. According to Brentano, determining predicates are those which enrich our knowledge of an object, singling out one of its properties: thus 'red' in 'red bag' is a determining predicate because there is something – a bag – which has the property of being red. On the other hand, an imagined thaler is not a thaler at all: 'imagined' (as well as 'dead' in 'dead man' or 'false' in 'false friend') is a modifying predicate because it does not point out a property of the object to which it is referred, but changes the meaning-function of the name to which it is tied (*Psychology from an Empirical Standpoint*, 1874, II, Chapter 7). It follows according to Brentano that *P* (e.g. 'red') is a determining predicate of *S* (e.g. 'bag') if and only if the being of an *S* which is *P* implies the being of *S*. If this is not the case, *P* is a modifying predicate.

For Anton Marty this distinction has a wide application in linguistics (*On the Origins of Language*, 1875). Connections of words do not necessarily match connections of meanings: there are syntactical constructions in which words are linked together in such a way that their respective functions are modified so that there is built up a syntactical sign whose elements, each taken separately, do not stand for parts of the intended meaning. Consider, e.g., the verb 'to turn out': by adding the word 'out' we do not thereby specify what kind of 'turning' we intend. The word 'out' does not function in 'turn out' like the word 'red' in 'red ink': the word 'out' does not determine, it modifies the meaning of the term to which it is connected. Here, composition takes place only at the linguistic level and is a means of designating new meanings without introducing new signs.

The theory of modification assumes a new form in Kazimierz Twardowski's *On the Content and Object of Presentation* (1894), which tackles the problem of the 'object of presentation' by applying the theory of modifying predicates to the description of intentional structures. Presentations may have objects: a real entity can be the goal of an intentional act, and it is then possible to speak about a 'presented object' in such a way that 'presented' functions as a determining predicate which states of a real object the property of being experienced by a subject. But there is also, for Twardowski, a sense in which every experience has its own intrinsic object, 'object' now, however, being understood in a modified sense. 'Presented', 'perceived', 'experienced', etc., can also be used as modifying predicates and in this case, according to Twardowski, the term 'presented object' means intentional content, and contents are necessarily parts of psychical acts. Thus for Twardowski the theory of modification is connected with the ambiguity of language, but its goal is to demonstrate how fluctuations in meaning due to modifying predicates are grounded in a two-fold directedness of intentional acts, to a content as well as to an object of presentation.

The thesis according to which there is a link between the theory of modification and a class of linguistic ambiguities was also developed by Edmund Husserl in his fourth *Logical Investigation*. Strictly speaking, the linguistic form '*A* is *b*' denotes and posits a state of affairs, but it can be used – in a modified sense – to express an assumption or to denote its own meaning (for example in '*A* is *b* is true'). Thus modification is a means of designating or expressing new meanings without introducing new signs. Moreover – according to Husserl – modification as a linguistic phenomenon rests on logical transformations of meaning: 'red' as a meaning has originally an adjectival form, but this can be nominalized and transformed into a substantival form as in 'red is a colour'. This difference in meaning is here not expressed by a difference in the linguistic form; thus the theory of

modification hints at that difference between linguistic and meaning structures which occurs if a class of transformations of a meaning is matched by no corresponding distinctions on the linguistic level.

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PAOLO SPINICCI

Monism/Pluralism

The problem of the one and the many is often thought the most fundamental of all metaphysical problems. Yet dispute as to whether reality consists of just one thing (monism) or of many (pluralism) can seem an idle question. For surely one can only count the instances of a definite concept, not mere 'things'. Reality is certainly just one universe, if 'universe' means the sum total of being treated as one vast particular. But surely to say so is to say nothing of significance, because the same total chunk of reality indisputably is or includes many instances of some other concept, say atoms or souls. Posed generally and without specification of the kinds of thing to be counted, the monism/pluralism dispute may well seem vacuous.

But this short way with the question may tacitly beg it, and in the monist's favour. For it takes for granted that one can ask questions about something called 'reality', and effectively treats this something as one. Not to beg the question against the stronger forms of pluralism, perhaps we should ask rather: 'Are there many things or just one thing?'. However, the monist will insist (as the stronger sort of pluralist must then deny) that questions of the pattern 'many F's or one?' only make sense as questions about the structure of a single reality. Thus the attempt to dissolve the problem is soon caught up in it. This suggests it may be unavoidable and basic.

Five main positions on the issue may be distinguished:

1. *Weak monism* asserts that there is a particular individual consisting of reality as a whole (call it the universe) about which we can ask intelligible questions.
2. *Weak pluralism* accepts this, but says that though there is indeed such a thing as the universe it is less like a single thing than are the paradigm cases of single things which it includes.
3. *Strong monism* adds to weak monism the claim that this particular individual has more of whatever makes us regard something as a single thing than does any other putative single thing to such an extent as to be alone worthy of being called an individual thing or substance.
4. *Intermediate monism* might say that it is as much a single thing as are the best cases of 'a single thing' which it includes.
5. Finally, *strong pluralism* says that there is no such particular individual as reality as a whole and that statements about something called the universe fail of reference. Weak monism, thus, is the common presupposition of weak pluralism and strong and intermediate monism, while strong pluralism rejects this presupposition.

It is essential to realize that the universe in the above must not be identified with the physical universe, unless on the basis of some more specific metaphysic. The universe, for the weak monist, might consist of the physical universe together with something non-physical, or of several physical universes, or again it might be conceived as not truly physical at all. (However, it is best to confine the question to the realm of the particular – universals *ante res*, if there be such, being left aside.)

The above classification is of forms of *individual monism* or *individual pluralism*, theories as to how many genuinely thing-like particular things there are and whether the most thing-like of all things is the universe. This dispute should be distinguished from that between *attribute* (or better: *kind-of-*

thing) *monism and pluralism*, as to how many absolutely different kinds of thing there are or how many absolutely different sorts of characteristics or attributes of things there are. The main dispute in this field is that between (a) mind–body dualism, (b) dual attribute theory, (c) idealism, and (d) materialism.

(a) implies what we might call:
(α) *strong kind-of-thing pluralism*, namely that there are at least two kinds of thing.

(b) suggests:
(β) *weak kind-of-thing monism* for which there is just one kind of thing though at least two quite different kinds of attribute which such things possess (this view might equally be called (γ) *weak attribute pluralism*).

(c) and (d) suggest:
(δ) *strong kind-of-thing monism*, according to which there is just one kind of thing with just one kind of attribute.

(α) implies weak or strong individual pluralism ((2) or (5) above), but β (or γ) and (δ) are compatible with each position in the individual monism versus individual pluralism dispute. The issues are quite different though intertwined. Traditionally the opposition of monism and pluralism has usually referred to that between individual monism and pluralism, but 'monism' is often used today to label materialist versions of (δ), as in Donald Davidson's doctrine of 'anomalous monism'.

The pre-Socratics mostly argued for various versions of kind-of-thing monism of a materialist character, while the dispute between individual monism and pluralism only became clear cut with the first great statements of individual monism in something like the sense of (3) by Parmenides (fl. 5th cent. BC) and his followers, Melissus (born *c.* 485 BC) and Zeno of Elea (*c.* 490 BC–*c.* 430 BC), and various pluralistic responses thereto, especially from the atomism of Leucippus (fl. *c.* 450 BC) and Democritus (*c* 460–*c.* 370 BC). In later Greek philosophy Stoicism was effectively a form of (3) and Epicureanism of a pluralist alternative. In modern philosophy Spinoza and Leibniz contrast as the classic exemplars respectively of individual monism in the sense of (3) and a more pluralistic alternative, combined in each case with weak kind-of-thing monism. In more recent times Hegel (1770–1831), Arthur Schopenhauer (1788–1860), Rudolf Hermann Lotze (1817–81), F. H. Bradley (1846–1924) etc. are chief proponents of (3) and Johann Friedrich Herbart (1776–1841), William James (1842–1910) and Bertrand Russell of (2) or (5), while all tended to kind-of-thing monism as is, indeed, the general rule among metaphysicians. Position (3) is characteristic of the Ādvaita Vedānta school of Hindu philosophy, while other schools, such as Sāṅkhya-Yoga, are more pluralistic in character.

Individual monism of type (3) is perhaps the most challenging of all these views, but has sometimes been defended facilely with arguments which suffice at best to establish (1). Parmenides, Hegel, and Bradley contrast with Spinoza and Melissus in taking their monism as excluding the infinitude of the universe in the sense of 'stretching out or going on for ever' or other kindred sense but as infinite in the allegedly deeper sense of having no limits not necessarily imposed by its own necessarily actualized nature. Some see modern physics as supporting a world view of this type with space-time as the one substance (though it will surely have to be granted a psychic aspect if it is to include mind).

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TIMOTHY L. S. SPRIGGE

Montague, Richard. See: Grammar II

Moore, G. E.

George Edward Moore was born in Upper Norwood near London in 1873. After studying classics at Dulwich College, he went up to Trinity College, Cambridge, in 1891. He continued his classical studies for the first two years, while also studying philosophy. In the summer of 1893 Moore became friendly with Bertrand Russell, who had come to Trinity in 1890, and in his third year he changed his majority to philosophy, studying with Henry Sidgwick (1838–1900), James Ward (1843–1925), G. F. Stout (1860–1944), and J. M. E. McTaggart (1866–1925). Moore wrote a dissertation on Kant's ethics and was elected to a six-year fellowship at Trinity in 1898. He left Cambridge in 1904, but returned to lecture in 1911 and succeeded Ward as professor of mental philosophy and logic in 1925. Moore was the editor of *Mind* from 1921 until 1947. Though he retired from teaching in 1939, he lectured in the United States from 1940 to 1944 and continued to hold discussion sessions with colleagues and students upon returning to Cambridge. He died in 1958.

In 1903 Moore published two works of great initial impact that became philosophical classics: "The refutation of idealism", which appeared in *Mind*; and *Principia Ethica*. In the latter Moore set out the view that intrinsic goodness is an unanalysable, non-natural property that is directly apprehended. A similar theme is involved in "The refutation of idealism", where Moore argued that *existence* does not analytically entail *being experienced*. Idealists might think that it does because they fail to distinguish mental acts from their objects and from facts that consist of acts apprehending objects. When idealists argue that *esse* is *percipi*, they confuse an *act of sensing*, the *object* sensed, and the fact that the act is an *awareness of* the object. This confusion is aided by the ambiguous use of the term 'sensation' to refer to all three things. Once they are distinguished, an idealist can only claim that there is a synthetic necessary connection between *esse* and *percipi*, and Moore holds that no one would believe this once it is clear what is claimed.

In *Principia* Moore argued that since *goodness* is an unanalysable, non-natural property, naturalistic theories, analysing goodness in terms of natural properties, and metaphysical theories, analysing it in terms of other non-natural properties, involved a fallacy. As in the refutation of idealism, his basic point was that such theories fallaciously offer an analysis of what is unanalysable. Being simple, goodness can only be directly grasped or intuited. That some thing or kind is intrinsically good is also directly apprehended, though Moore proposed a method of sorts for arriving at such apprehension: imagine something to be the only existent and consider whether it is better that it exist or not. Moore's notion of a non-natural property provoked discussions that have persisted for over three-quarters of a century. In a reply to C. D. Broad (1887–1971), Moore said that he did not know what he had meant when he spoke of a non-natural property as not capable of existing by itself in time and as not being a part of the objects it characterized. Yet as we shall see, what he meant is nc mysterious.

In "The nature of judgement" (*Mina* 1899), Moore takes simple universal concepts, including *existence*, colour concepts, temporal and spatial concepts, to be the ultimate constituents of the universe. Propositions, both true and false, are complexes of concepts, as are existent objects, which Moore construes as true existential propositions. This latter theme results from his taking an ordinary object, such as a table, to be a complex composed of the concepts in the complex concept of the *table* together with the concept of existence. As the proposition that the table exists is also taken to be a complex of the concept of the table and the concept of existence, it is not surprising, as Moore reported in a letter to Russell, to 'discover' that existent objects are true existential propositions. In 1899 he also suggests that a universal concept like blue combines with spatial and temporal concepts (here, now) to form a spatio-temporal instance that is a constituent quality of an object such as a blue flower.

In a paper, "Identity", published in the *Proceedings of the Aristotelian Society* of 1901, Moore focuses on the distinction between the particular quality instances that are

parts of objects and universal concepts. Quality instances are taken to be basic particulars that stand in a certain primitive relation to a universal concept or Platonic idea.

These early papers reveal what lies behind his notions of *natural* and *non-natural* property in *Principia*. When a natural property like blue is truly attributed to an object, there is an instance of blue, a certain spatio-temporal particular, that is a part of the ordinary object. Thus blue is characterized in *Principia* as existing in time and being natural, but the phrase 'natural property' is used ambiguously; sometimes to refer to a universal like blue, and sometimes to its quality instances. A non-natural property in contrast does not have instances that are temporal parts of ordinary, natural objects. Thus, non-natural properties are not parts but mere 'predicates' of such objects. As there are no particular instances of goodness that are parts of what is good, goodness is *not a temporal existent* but a mere 'predicate' of objects. Goodness does, however, depend on natural properties in that it is predicated of a whole in virtue of the latter's natural properties.

"The nature of judgement" and "Identity" were also directed against idealism, the first by holding that there were objective universal concepts and true propositions, composed of concepts existing independently of minds. As opposed to the idealist's coherence theory of truth, as well as to correspondence theories, Moore held a proposition to be true in virtue of an internal *connection* that combined the constituent concepts in the proposition. In "Identity" Moore argued, along lines Russell would reiterate in a celebrated paper, "On the relations of universals and particulars" in the *Proceedings of the Aristotelian Society* for 1911, that the construal of particulars as bundles of universal concepts cannot account for *numerical difference*. As the difference of objects cannot be accounted for solely in terms of conceptual difference, particulars that differ only numerically must be acknowledged.

In lectures given in 1910–11 and published in 1952 as *Some Main Problems of Philosophy*, Moore set out new accounts of perception, truth, and intentionality. In "The refutation of idealism" he had claimed that we directly apprehend material objects. In 1910 Moore rejects this earlier claim and sees idealists and sceptics as failing to distinguish between the *direct* and the *indirect* apprehension of an object. This distinction depends on his analysis of belief. Moore takes a belief such as "This is an envelope" to involve a mental act, *m*, that is the direct apprehension of a proposition. The proposition in turn stands in a basic reference relation to a fact, and the existence of the fact grounds the truth of the proposition. The proposition is also *about* the constituents of the fact. Consequently, the mental act *m* is also an indirect apprehension of an object, in this case the envelope. Moore, however, was bothered by the problems raised by false propositions, and, as the book progresses, *beliefs* replace propositions, a belief being implicitly taken to be a common property of mental acts that *are* 'beliefs' of the 'same kind'.

Moore took the *perception* of a material object to involve

1. an act that is the direct apprehension of a sense-datum and
2. an act of belief that there is a material object related to the sense-datum in an unspecified way.

Such an act of belief is an indirect apprehension of the material object whose existence makes the belief true. (Whether the acts cited in 1. and 2. are the same is not specified.) Perceptions of material objects thus involve acts of belief. Moreover, what is believed is here immediately known to be true. Idealists and radical empiricists mistakenly think that existential claims about material objects must be based on inferences from sense-data and hence cannot be immediately known to be true. The mistake is due to confusing *direct apprehension of* with *immediate knowledge of*. We do not directly apprehend material objects; but we do have immediate knowledge of truths about them. Though we know such truths only upon directly apprehending sense-data, we do not infer them from truths about such data. In discussing truth and belief, Moore also set out an early variant of

Alfred Tarski's Convention-T as a condition for a theory of truth.

In a celebrated paper, "External and internal relations" (*Proceedings of the Aristotelian Society*, 1919), Moore held that true identity statements are necessary truths and criticized idealists' views about internal relations and identity. In other writings, he sought to clarify the nature of analysis, the relation between material objects and sense-data, and the connection between natural and value properties. He also sought to resolve problems about our knowledge of material objects and to specify further conditions for a viable analysis of knowledge, since justified true belief does not suffice. In his early papers and in *Principia Ethica*, Moore had written as if he directly apprehended not only concepts, but also that they are simple or complex and whether one concept is involved in the analysis of another. In his actual practice, however, he tested proposed conceptual analyses by considering whether certain situations were logically possible, such as something being good but not pleasant. Increasingly, he invoked what is ordinarily considered possible, rejecting philosophical claims in conflict with common sense and relying on ordinary linguistic use rather than on a purported apprehension of concepts. Thus, linguistic analysis replaced ontological analysis, and Moore's style of philosophizing, perhaps more than Ludwig Wittgenstein's, instigated and influenced the 20th-century preoccupation with ordinary language.

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HERBERT HOCHBERG

Morals

The Kernel of Morality. Morality is minimally the negative ideal of all members of each community living in harmony in their free pursuit of individual goals and group plans, with minimal disturbance from others and from institutions. Slightly positive is the ideal of everybody, not merely not hurting, but helping the others in their satisfactions of basic needs and pursuit of goals. In any case, morality is primarily social morality: moral duties to oneself are at best minor corollaries of a special puritanical version of that ideal. This ideal yields a schema of demands that presuppose a view of both human agency and the world. Morality presupposes that moral agents are endowed with certain intellectual and practical abilities. First, there is the manifold of abilities constituting agency in general. Agents make decisions and adopt plans: they have the power to choose courses of action and act intentionally and at will. They also have the abilities required for carrying out some of their plans. Second, there are the abilities specifically required for morally relevant agency. Moral agents have internalized in their action-mechanisms rule constitutive of a code purporting to embody the idea of morality. Further, moral agents are assumed to be capable of appreciating at least elementary conflicts between their own and others' interests and are able to some extent to sacrifice their own interests.

Morality builds its demands on these presupposed abilities. The core of morality demands that all human beings *qua* agents be treated equally, regardless of their abilities and station. That is, each agent is morally entitled to the maximal respect for his projects – with the minimal restrictions and the maximal co-operation – compatible with equal maximal freedom and minimal interference for everybody else. The assumption that this ideal is to some degree feasible is the source and the background of the division of communities into institutions, clubs, associations, and ephemeral groupings as those created by particular acts of promising. The ideal sustains the criticism of institutions and often guides their revision.

That demand of equality is the core of the

normative scheme embedded in moral codes. It is captured in the following two schematic principles:

1. The ideal of morality *demands*, in the presence of certain conflicts between an agent's interest and the interest of others, that the agent sacrifice his own interest.
2. That demand is subject to some structural constraints:
   (a) The others' interest must pertain to some basic need, or be very crucial or much more significant to their life plans than the agent's interest is to his own life plans.
   (b) There are certain *moral thresholds* beyond which the agent's self-sacrifice lies outside moral injunction; for example, morality never demands the maximal sacrifice of the agent's life.
   (c) The exact determination of the moral thresholds depends on information, or beliefs, about human nature and about the environment. They allow of convention or stipulation.

Moral thresholds are natural junctures where moral codes may differ. They constitute dimensions of moral relativity. This is as it must be. On the one hand, different communities may differ in their members' physical stamina and psychological resilience; the different environments may be bountiful or hostile. On the other hand, the very same desiderata may be fulfilled in different ways. For instance, the same conception of orderly transport, economy of effort, and convenience is achieved by driving on the left as well as by driving on the right.

The moral thresholds of self-sacrifice determine a boundary within which each person is morally – alas! not factually – secure to insist on his own individual purposes and plans. These and their boundary constitute the agent's *moral dignity*. Because of their dignities, agents are not mere intersubstitutable units to be added in purely numerical computations of the greatest happiness or freedom of the members of the community. The boundary of an agent's dignity is for the other agents a boundary of moral taboos: beyond them they are not morally entitled to demand submission or immolation. Here lies the foundation of the personal character of punishment and reward. For instance, it is morally wrong to sacrifice the known innocent to pacify a community in panic because of a mysterious callous criminal. Likewise, it is morally required to reward the actually deserving persons.

Morality is, however, not so totalitarian that for every action A it demands that either one ought morally to do A or one ought morally not to do A. Hence, nobody is morally forbidden voluntarily to transgress his moral thresholds. Self-sacrifice beyond the call of duty might perhaps be foolish, but it need never be immoral.

Freedom, Causal Determinism, Ugly Universes. The ideal of morality pivots on a presupposition of *freedom*. It presupposes two levels of freedom. The moral agent is supposed to choose his projects and life plans freely, and is also assumed to be free to choose to sacrifice his own good in favour of the others' good; that is, the moral agent is free to subordinate his will to the moral rule. Thus the ideal of morality sits on deep metaphysical uncertainty.

For centuries morality has been thought to have an anti-scientific bent. Up to the end of the 19th century the principle of universal causal determination was a fundamental dogma of scientific activity: morality, on the other hand, has always pivoted on the postulate of freedom. This has been, and will be, the fountain of the most ingenious, intriguing, and perplexing debates. Some philosophers have proclaimed that moral duty and moral responsibility are an illusion worse than witchcraft. Others have become anti-scientific. Most philosophers, with a foot on each side, have attempted to reconcile the irreconcilable: freedom is the logical possibility of having been able to do otherwise; freedom is simply ignorance of causal connections; freedom is absence of coercion; freedom is just internal causation from one's own impulses; free action is action that conforms to one's highest desires. The debate

still rages furiously. Some find comfort in the indeterminism of quantum mechanics. Others reply that unpredictable quantum jumps cannot account for human freedom. Certainly we must not try to reduce freedom of choice to wholly unpredictable changes in quantum phenomena in the brain. Others rejoin by affirming that freedom to choose is, nevertheless, freedom to insert changes in the physical world. Freedom of the will thus presupposes physical indeterminism. In any case, the indeterminism involved in freedom cannot be a matter of wholly unpredictable quantum jumps; it must be structured: it must occur within a framework of a determined range of open choices.

Freedom of choice – whether real or not – is restricted indeterminism *a parte ante*: the open choices are prior to the chosen action. It does, however, presuppose a partial determinism *a parte post*: an action not causally determined, within a determined range of freedom, is supposed to be freely chosen on the assumption that the very choosing of it will cause it to exist; furthermore, it is assumed, or hoped, that its existence will cause other desired states of affairs.

We often deliberate about what to do and conclude our deliberations by choosing a course of action. Suppose that I believe firmly that I am determined to do action A, that is, I am utterly convinced that in fact I have no open or real alternatives to doing A. Then I do not deliberate or choose to do A: I may curse my fate, or I may resign myself to doing A against my will. For example, I am unavoidably sliding down a ramp and I see that I will collide with a child down below. I have no choice: I will collide. I have no choice because I am causally determined to collide. In general, when I (try to) choose to do A, I believe that I am not causally determined to do A. I may perhaps believe that I *must* be causally determined to choose *whether* to A or to B or to C. The causal determination of the type of action – a choosing – is not the issue. The question is about the causal determination of the particular action – doing (even a choosing to do) A, or, alternatively, doing B, or doing C.

Now, the experience of choosing establishes *only* that the agent believes or takes himself to be free to choose A, or B, or C. As Kant remarked in his *Groundwork of the Metaphysics of Morals* (1785), it is the use of the idea of freedom, rather than freedom itself, which is involved in voluntary action. From the fact that we believe ourselves to be free to choose what to do, it does not follow that we are in fact free to do so. Here, however, we are confronting, not merely some peculiar fact about particular agents, but a fundamental fact about the general experience of choosing, namely:

> For any person X: X's choosing at time t to A *implies* X's taking it for granted (rather than: explicitly assuming) at t he is free to choose to A.

This principle pertains to the logic of choosing. The implication it records is the *phenomenological datum* of choosing. It is an implication between mental states. It does not by itself establish the truth of *what* in order to choose one must suppose to be true.

A universe containing acts (for instance, of choosing) that require a false belief or presupposition (say, of not being completely determined to make the choices we in fact make, when we make them) is *ugly*, the uglier the more deeply seated is the taking for granted of the falsehood in question. It is both aesthetically and metaphysically ugly. It would be a twisted, somewhat incoherent universe: believing is a mechanism necessarily oriented toward truth, truth having survival value, yet in that kind of universe (whether by evolution or by God's design) the most important mechanism of human survival – voluntary and intentionally action – is built essentially on a pivotal false belief.

None the less, the actual universe may very well be ugly. This is the profound uncertainty on which morality rests: whether the universe containing human agents – let alone moral agents – is or is not ugly. The exercise of agency assumes that the universe is not ugly. Notwithstanding, our efforts at acting morally may be metaphysically illusory and may occur within an ugly universe.

Freedom and Evolution. Apparently freedom of choice – whether real or not – presupposes a narrower domain of effective

alternatives than biological evolution. On the other side, the exercise of a free choice, being a purely individual response to the world, need not alter the posterior recurrence of the freedom involved in that choice. The rupture of causal determination involved in evolution requires, in contrast, a resumption of a general deterministic pattern. The mutations undergone by the individuals of a species become fixed as traits of new biological variety. The execution of an action *A* freely chosen, on the other hand, need not, and better not, crystallize in a fixed habit to do *A*.

Choosing is a well-entrenched practice in human life. This practice presupposes that normally one's choices are efficacious. This underlying efficaciousness can be traced to an environment hospitable to human life, on which evolution erects the practice of choosing. Thus our ability to deliberate, and our need to choose actions under the deeply seated assumption of freedom, are both the work of evolution. The initial rupture in a deterministic universe that caused freedom of choice crystallized in a characteristic human trait.

The Self: Objectivity/Subjectivity, Identity/Sameness. Deliberation and intention are primarily first-person affairs. One can of course deliberate vicariously on behalf of another agent, for example, when one is asked by another for advice, as if one were in his shoes, or when one offers a reasoned entreaty. Advice and entreaty assume that the addressee will, or may, transform the reasons of the form: 'You are (should) . . .' into first-person reasons of the form: 'I am (should) . . .', and the advice 'Do *A*' into a decision 'Yes, I will do *A*'. But what is this *I* on which intentional action hinges? The assumption underlying deliberation is that what one calls *I* is something very special. And so it is. Certainly, it is different from one's body; in fact it is really not anything one can find in the world. One can, having become amnesiac and having lost the powers of touch and sight, wonder: 'Who am I?' One thereby manifests a full grasp of oneself and enquires about one's place in the world order. One *as such* is not necessarily identical to anything physical or historical in the world. One can think consistently that one existed at a different time and imagine the history of the world passing before one's sight. I can consistently take myself out of the whole objective world and doubt whether it is all an illusion. Thus it is thinkable that I may be nothing in the world.

What am I really? This question, very different from 'Who am I really?', has led to many different metaphysical views. The above observations suggest a *non-mundane* nature of the *I*s. Some philosophers have, positively, adduced such observations in support of an extramundane immortal soul. Other philosophers, believing that whatever exists is mundane, have argued, conversely, that there is no *I* at all; some explain the *I* illusion as a linguistic hypostasis resulting from the use of the first-person pronoun. The idea is both that we could refrain from using the first-person pronoun without any loss and that if we did so we would see the *I*s vanishing – just as witches have disappeared from the world by our never resorting to them to explain some persons' strange behaviour.

The fact is that we could not stop thinking in the first-person way as long as we deliberate and adopt plans. It is true that Charles de Gaulle used to speak of himself in the third person: "De Gaulle thinks (believes, knows) that . . .". He could do it just because he believed that *he himself* was de Gaulle, that is, he believed the truth he refused to voice, but could have voiced, by saying "*I* am de Gaulle". He knew quite well who he was.

Let's return to the question *Who am I?* It shows the other side of the *I*s. *What*ever I may be, if I am agent, thus acting in the world, then there must be someone who I am. It is who I am that has the powers to act. Thus, though non-mundane, the *I*s of agency are necessarily *co-mundane*: they have to be the SAME as something *in* the world, a *something* that has a definite place in the causal order, and is tied down to a certain time. *Who* I am is mundane, even though *I* am strictly not mundane; yet we are the same. Thus the main axiom in the logic of the *I* is this:

(I*) Let $F(\ldots I\ldots)$ be any proposition containing one or more agential first-person references. Then: $F(\ldots I\ldots)$ entails: There

exists a physical entity *B* such that I am the same as *B* and *F*(...*B*...).

Here we face two sets of metaphysical issues. First, there is within reality the mundane/non-mundane contrast. It is essentially the contrast between the objective world and the subjective representations of it. Second, there is the identity/sameness contrast. These contrasts converge. Thus, the truth 'I am (the same as) the author of *The Structure of Morality*' involves the following:

1. *I* am strictly (identical to) a purely subjective entity,
2. the author of *The Structure of Morality* is a purely objective entity in the causal order of the world, and
3. there is a mixed mundane (objective)/non-mundane (subjective) sameness between the two.

This suggests that, although the core of reality is objective, total reality includes subjective tails or developments that function as means of knowing the objective. The objective or mundane is the sharable, intersubjective physical world. The subjective contents of experience are by default oriented to the mundane: they are the mechanisms through which objects in the world represent and act on the world. By (I*) the mundanity of the *I* is its co-mundanity: each non-mundane (subjective) individual *I* is metaphysically required to be the same (in the appropriate existential sense) as something physical through which the agent has mundane effects. Thus, each agent's *I* is the agent's mechanism of representing its own agency as a source of activity.

An *I* is the subjective representation of a self-reflective thinker. Is it a permanent representation residing deeply in the agent's manifolds of powers to think? Is it an ephemeral representation lasting as long as the episode of self-consciousness lasts? Undoubtedly, the constancy of the thinking agent in the world requires a lasting power to think *I* every time the agent is self-reflective. Nevertheless, the permanence of a power does not imply the permanence of its manifestations – unless it is permanently exercised. It is a fact, however, that our consciousness is intermittent, and self-consciousness is even more intermittent. In deep sleep we lose consciousness altogether, and when we become absorbed in a problem or in a show we are engaged in *I*-less, non-reflexive consciousness. It seems, then, that the *I*-mechanism of representation is enduring: its possession is precisely the power to be self-conscious. The *I*s which the exercise of the *I*-mechanism delivers are actual but ephemeral representations of the agent to himself. The *I* vanishes when self-consciousness vanishes. The *I* of an episode of self-consciousness can ground neither a metaphysical mental substance nor a theological soul nor an empirically characterizable permanent body. (This is, of course, a controversial account.)

Bodies and Their Minds. The problem of what the self or the *I* is lies at the core of the metaphysics of agency. Yet it is only one paramount instance of the general problem of the mind–body relation and the role of consciousness in the world. There are many views on mind and consciousness. Up to the 17th century reductions of the physical to the mere contents of consciousness were fashionable. Nowadays the dominant trend is to reduce the mental to the physical. The preceding brief discussion of the co-mundanity of the *I* steers a non-reductionist course. It is slanted in favour of physicalism, by conceding to it the whole world, the mundane. Furthermore, by conceding primary reality to the physical order of the world it also concedes a causal primacy to the physical. The mental, even if irreducible, must be anchored to the physical. Nevertheless, the metaphysical primacy of the objective is not *ipso facto* the annihilation of the mental. Thus, as far as the preceding discussion of subjectivity reaches, it may be metaphysically true that the mental supervenes on the physical. If the mental is not to be merely epiphenomenal, then a causal role for episodes of consciousness must be established. To be sure, the non-epiphenomenal character of consciousness does not eliminate the ugliness of a universe in which freedom to choose is metaphysically illusory.

Moral Codes: Their Four-Storeyed Structure. The preceding metaphysical presup-

positions undergird the mere concept of (intentional) agency. Moral agency makes additional presuppositions. These are essentially epistemological. That is, the metaphysics of moral agency is the metaphysics of agency together with the metaphysics of morally relevant knowledge or conjecture.

The above remarks offer only the *kernel* of the ideal of morality. This ideal should of course be spelled out in full. The formulation of the ideal of morality in full is itself another ideal. The formulation of a moral code that is a perfect embodiment of morality is a super-ideal lying entirely beyond our reach. For one thing, as observed above, the moral thresholds constitutive of a moral code allow of stipulation and convention. In general, however, the formulation of a moral code requires precise knowledge of human nature and its diverse types, and rich knowledge of the world and its means for human subsistence and happiness, including the advances in technology. Clearly, this would be feasible only if all the sciences, natural and human, had already completed their tasks. Then there would remain only the enquiry to ascertain each and every agent's total hierarchy of purposes and life plans. In this sense a moral code is, further, much more difficult and uncertain than a scientific theory. Like a scientific theory, a moral code, regardless of how schematically it is conceived, is a conjecture, a *posit*, about the overall happy outcome of the interaction between the world and the agents with minimal interference, if not co-operation, among the agents themselves.

With some general assumptions about human nature and the world we can construct a *general schema of morality*. Schema, I say, advisedly. We can be reasonably certain of the *structure* of morality. The contents of morality are, however, something else. Yet the ideal, whether in its kernel form, or as a structured schema, is by itself nothing, unless it gains some content. For this the schema must be embodied in a large network of shared beliefs about the nature of the agents and about the environment in their habitat. It can then, enriched with further specific empirical beliefs, be the foundation of a moral code. Doubtless, if the ideal is to be of any good, the beliefs on which it is mounted, and the beliefs with which it is enriched, must be true. These are – however difficult they may be to achieve – empirical and not metaphysical beliefs. Metaphysically the crucial point is that each moral code, presupposing a wealth of beliefs about human nature and the world, is a posit as to how we can all live the best feasible lives we can choose. With changes in knowledge and developments in technology we ought morally to revise our moral code. Morality recognizes our finitude and, hence, demands that we be alert so as to be able to engage in moral progress.

Most classical theories of morality are answers to one question: 'What ought I morally to do here now?' Their underlying assumption is that each person in each given circumstance faces that question understood as monolithically requiring *one* answer. This assumption is in error. It fails to take into consideration the crucial fact about human nature that given our finitude we must organize our actions in plans with others. This need is the foundation of our institutions. *Human beings are necessarily institutional beings.* Hence, our primary duties and rules are not moral, but institutional. Morality enters the scene when conflicts in institutional duties are not resolved within the existing institutions. Then the need becomes urgent for a general point of view from which all such conflicts can be solved. The generality of the needed point of view presupposes human dignity and everybody's freedom to choose his biography; hence, it demands universal respect for that dignity and that freedom. To be sure, reflection suggests the whole of one's own community and, even, humankind as comprehensive institutions. Morality, thus, also deals with personal conflicts of interest outside institutions. On this correct insight moral philosophers have built the view of morality as being concerned, exclusively, with the above monolithic question.

Morality must take into account human finitude and the institutional character of agency. These abstract metaphysical aspects are certain. To be serviceable the ideal morality must be embodied in a moral code, built on specific hypotheses about human nature and about the surrounding environ-

ment. These are uncertain. Thus a moral code has a four-storeyed structure:

1. The *euergetical* level (εὐεργετεώ = to do good), where we find the vague interpersonal duties to treat others as we treat ourselves, or to avoid causing pointless suffering. These are the vague rules that classical theories aim at elucidating under proposals like: act in accordance with a universal maxim, or maximize happiness.
2. The *ethical* or meta-institutional level (ἦθος custom, practice), which prescribes a uniform solution to conflicts of duties.
3. The principles of moral ranking of institutions and the kernel of the ideal of morality, which provide the basis for the ethical duty to solve conflicts of duties.
4. The metathetical level (μετάθεσις = change), where the moral code is self-corrective and occasionally enjoins the changing of levels (1) or (3).

A correct theory of morality, built on the proper metaphysical foundations, does not take the moral question 'What ought I morally to do here now?' as monolithic. The question allows of a threefold answer, because it has three different moral interpretations, depending on whether the moral duty at issue is a euergetical, an ethical, or a metathetical one. These answers may conflict. Then there is a truly moral conflict.

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HECTOR-NERI CASTAÑEDA

Moses Maimonides

Moses Maimonides was an outstanding Jewish philosopher, jurist, physician, and communal leader. He was born in 1138 in Cordoba, Spain. At an early age he and his family were forced to flee Spain because of religious persecution. After years of moving around North Africa and Palestine, he settled in Fostat (Old Cairo), Egypt, where he stayed until his death in 1205. His major literary works include the *Mishneh Torah* (*c.* 1177), the most comprehensive code of Jewish law ever written, and *The Guide of the Perplexed* (1200), the most famous Jewish philosophical book. Maimonides was heir to a rich tradition of Arabic science and philosophy, and his own philosophical and medical works, written in Judaeo-Arabic, bear witness to this tradition.

When Maimonides speaks of 'metaphysics' in his various writings, he usually intends what the Arab philosophers called 'divine science', that is, theology. Divine science is characterized in the *Guide* as the apprehension of God (1.34) and the apprehension of the agent intellect (1.62), the celestial intelligence responsible for bestowing the forms of existence upon sublunar entities and the forms of thought upon the human intellect. The scope of metaphysics is said to encompass such topics as the existence, unity, and incorporeality of God, the signification of divine names and attributes, and the explanation of prophecy, providence, and divine knowledge and creation. In fact the scope is much broader, since these topics require for their proper elucidation a solid grounding in Aristotelian physics and metaphysics. Thus, in order to prove the existence, unity, and incorporeality of God, Maimonides appeals to premisses based on the Aristotelian concepts of potency and act, essence and existence, matter and form, necessity and possib-

ility, and causality. But these premisses are cited with little explanation, and no proof, the reader being directed to the 'books of the philosophers' for further explanation.

Although Maimonides makes no reference to the metaphysical writings of earlier Jewish philosophers, he claims that metaphysics was studied by the ancient Jewish sages under the rubric of *ma'aseh merqabah* (literally: 'account of the Chariot', the Rabbinic-esoteric speculation concerning the heavenly chariot seen by the prophet Ezekiel; see *Mishnah*: *Hagigah* 2.1). This claim was of immense importance for the subsequent history of Jewish philosophy in that it legitimized the study of metaphysics from a Jewish standpoint, though at the same time restricting that study to a select élite.

The metaphysical system found in Maimonides's writings is that of the Moslem Aristotelians, especially Alfarabi (*c.* 870–950) and Avicenna (980–1037). The foundation of the system is God, variously described as 'Necessary Existent', 'Supreme Intellect', and 'Prime Cause', who perpetually causes and sustains the existence of all other existents. The latter, which are dependent ontologically upon the Necessary Existent, are divided into three classes: corruptible hylomorphic entities (terrestrial bodies), incorruptible hylomorphic entities (celestial bodies), and incorruptible immaterial entities (celestial intelligences). As in other medieval Neoplatonic–Aristotelian systems, existence flows from God to the sublunar world through the medium of celestial spheres and intelligences.

What appears to distinguish Maimonides's system from those of the Moslem Peripatetics is the role he assigns to divine will. God created the world *ex nihilo* through a purposeful and unconstrained act, not through any inner necessity of nature. Though the workings of the world can be explained by and large on a naturalistic model, traces of divine will are observable in the irregular movement of the spheres and the stars and in the occurrence of miracles. Yet it must be said that even this small amount of voluntarism (perhaps influenced by the writings of the Moslem theologian Algazel (1058–1111)) cannot easily be reconciled with his otherwise naturalistic system, causing some scholars to doubt its genuineness.

The lack of fit between divine voluntarism and Aristotelian naturalism is evidenced in Maimonides's limited acceptance of the classical principle of plenitude: "Every real possibility must be realized at some time" (*Guide* 2.1; cf. *Letter to Ibn Tibbon*). While Maimonides asserts the principle in his third method for proving God's existence, he limits its application with respect to divine possibilities: God could have created a different world than he did. Unless it was possible for God to have created a different world, the world he did create could not be a product of his freely chosen and purposeful act. Maimonides appears to reconcile this voluntarism with Aristotelian naturalism when he holds that God, in the act of creating, freely chose an Aristotelian world, a world in which the principle of plenitude has full scope.

Because of the exalted nature of its subject matter, the science of metaphysics is beset by limitations. Man can prove conclusively that God's existence is necessary, unique, and incorporeal, but he cannot apprehend his essence, nor, for that matter, the essences of immaterial entities such as the separate intelligences (1.37). The inherent limitations of material creatures preclude any precise insight into the workings of divine knowledge and providence; metaphysical questions concerning the origin of the world cannot *in principle* be answered conclusively because of the irreducible element of divine will (2.24). Moreover, human language is unable to express anything positively about the divine essence without detracting from God's uniqueness, for positive attributes imply a relationship between him and his creatures (1.56).

Maimonides may have gone further than his Islamic predecessors in emphasizing the limitations of human knowledge and the impossibility of ultimate metaphysical knowledge, although this is a matter of scholarly dispute. In any event, he states throughout his writings that men can attain knowledge of God "according to their ability" – indeed, doing so is mandated by the Torah – and he holds that most of the premisses of Aristotelian metaphysics have been demonstrated

to be correct (2.Int). Moreover, although a concept of God cannot be obtained through direct apprehension of his essence, it can be constructed through a process of negation of incompatible predicates (1.60).

Maimonides's theory of the human soul, though not part of his metaphysics proper, is important for understanding his ontology. Like most Aristotelians he considers the soul as the entelechy of the body, but unlike some he denies that it, or any part thereof, constitutes a separate incorporeal substance. Human intellect is described as a "mere faculty or predisposition" to receive the forms of thought (intelligibles); although Maimonides calls this predisposition 'corporeal', he probably means thereby that the human intellect inheres in body rather than that it is actually body itself (Altmann 1987, p. 67).

The ontological dependence of the human intellect on the body rules out the possibility of its continued existence after an individual's death. Yet, while the human intellect as a predisposition to receive the intelligibles ceases to exist, the intelligibles that were acquired during an individual's lifetime do not; these acquired intelligibles constitute what Maimonides calls "the thing that remains" after death (1.40, 1.41, 3.22). Whether this 'thing' is an individual or a general intellect is a question of interpretation on which there is no scholarly unanimity.

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Multiple Relation Theories

Multiple relation theories were propounded by Bertrand Russell between 1907 and 1913 in an attempt to avoid having to admit propositions as genuine (or logical) subjects. On such theories, propositions such as 'Othello believes that Desdemona loves Cassio', where a proposition apparently functions as a term of a relation, are analysed in such a way that the propositional component disappears. Thus the example is not analysed as a two-place relation between Othello and the proposition that Desdemona loves Cassio, but as a four-place (multiple) relation between Othello and the constituents of the apparent proposition, viz. Desdemona, loves, and Cassio. As analysed, 'believes' is the main (or relating) relation and the subordinate relation, 'loves', occurs as a term. On the multiple relation theory, propositional symbols may never stand alone, but always within the scope of a functor, a so-called propositional attitude (often implicit in natural language), such as 'believes', 'asserts', 'suggests', 'doubts', etc. The complex of functor and propositional symbol can then be analysed by means of multiple relations in such a way that the propositional symbol is eliminated. Propositional symbols are thus incomplete symbols, meaningless in isolation and eliminable by means of multiple relations from any context in which they occur.

Russell felt himself forced to the theory by the need to avoid having to suppose that there were such things as false propositions. Although he usually discusses judgement (or belief) when presenting the theory, it is clear that the theory must apply to all propositional attitudes. Indeed, Russell uses the theory to give a complete account of propositions as they occur in *Principia Mathematica*, including the theory of truth. For propositions are nothing but false abstractions generated by multiple relations. It is thus clear that the theory of propositional orders, Russell's characteristic view that propositions and their apparent properties have significance ranges determined by their position within a hierarchy of orders, must also be based upon multiple relations (*Principia Mathematica*, I, pp. 44–5). Moreover, the elimination of

propositions was used by Russell as part of his justification of type theory (*Principia*, I, p. 48). The importance of this fact was first noted by Sommerville (1979).

The theory faces a number of difficulties. In the first place, different putative propositions have different numbers of constituents. Thus a multiple relation, like belief, will not always be a four-place relation, and so must either be variably polyadic (a situation Russell seems not to have envisaged) or else systematically ambiguous. Another technical problem is that of extending the theory to locally compound judgements. Russell (1911, 1913) handles negation by introducing disbelief as a new multiple relation; and conjunction is straightforward. But disjunction is problematic unless logical operations are admitted as terms. In *Principia* Russell sketched an extension to quantified judgements.

More serious is the problem of distinguishing Othello's belief that Desdemona loves Cassio from his belief that Cassio loves Desdemona. Russell tackled this problem in different ways during the years in which he held the theory. Initially, he argued that the distinction was to be made by means of the subordinate relation which was directed either from Desdemona to Cassio or vice versa (Russell 1910). But this will not do, since the subordinate relation is a term and does not relate other terms and thus can have no direction from one term to the other. Subsequently, Russell argued that the multiple relation itself provides the requisite order for its terms (*The Problems of Philosophy*). The trouble here is that the multiple relation must somehow relate three of its terms, Desdemona, loves, and Cassio, not merely to the fourth, but among themselves also. It is not clear how it can do this without resurrecting propositions, or something very like them. Finally, Russell suggested that, since the problem arises because the terms Desdemona and Cassio can be related by love in two different ways to produce two different possible complexes, it could be solved by eliminating such relations in favour of what he called "non-permutative relations" which, when supplied with terms, could yield only one possible complex. He gave an elaborate account of this procedure (Russell 1913).

The most serious objection, however, was raised by Ludwig Wittgenstein in a letter to Russell of June 1913 and led to Russell's abandoning the theory. Wittgenstein argued that, by treating the subordinate relation as a term, Russell had made it impossible to exclude nonsensical combinations (e.g. 'loves Desdemona Cassio'). While Russell did not wish to admit any propositions as logical subjects, he did not wish to admit combinations of this kind even as false abstractions, since to do so would violate the significance constraints he imposed on propositions through the theory of types. Since type theory was to be built (in part, at least) upon the multiple relation theory, the admission of nonsensical combinations as false abstractions would violate the very doctrine the multiple relation theory was intended to support. Nonsensical combinations could only be excluded if prior judgements were made to assign terms to types (thus, e.g., making it clear that 'loves' was of a different type to 'Desdemona' and 'Cassio'). But such judgements would then be prior to the multiple relation theory, and multiple relations could no longer provide a satisfactory and complete account of judgement, nor the means for an elimination of propositions.

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Music

The central question of the ontology of music is: What kinds of things are musical *works* (or *compositions*)? Such a question properly

arises only in certain musical domains, notably that of Western 'classical' music (to which this essay will be implicitly restricted); it has no purchase in others, such as that of purely improvisatory jazz, or that of many folk genres around the world, where the idea of a repeatable, instantiable, non-occasion-bound musical entity is absent. (In such domains, we might say, the musical object is straightforwardly just *the particular event of playing* on a given occasion or, perhaps, just the *sounds* thus produced.)

It is clear that a paradigm musical work in the Western tradition, e.g. Brahms's Second Symphony, is not any physical object or event whatsoever. In particular, it is not identical with any performance of it, the idiom of 'performance of' itself attesting to the distinctness of performance and that which is performed, and is equally not to be identified with any score of it, whether original manuscript or mass-produced copy, for such things are evidently seen and not, as is required, heard. Furthermore, a musical work generally predates any of its performances, and can easily postdate the destruction of all scores thereof. On the other hand, scores and performances are of the utmost importance; musical works in this tradition are largely defined by the former, and experienced, known through the latter.

Views on the Nature of the Musical Work. It is, then, agreed by all that a work of music is not a physical entity. Views of what it has been taken to be instead are roughly four in number, three of which hold in common that a musical work is some variety of *abstract* thing. The first view is that a musical work is a *set* or *class* of performances. The second is that it is a *pure universal or type*, such as a sound structure or pattern, or some other congery of purely musical properties. The third is that it is rather a *qualified or contextualized type*, akin to other products of culture in being creatable and bound to specific persons, times, and places of origin. The fourth is that it is a *mental* event or occurrence, something existing properly in the minds of composers, and perhaps eventually, of their interpreters and audiences. The first view has been advanced by Nelson Goodman, the second by R. Wollheim, N. Wolterstorff and P. Kivy, the third by J. Margolis and J. Levinson, and the fourth by Benedetto Croce (1866–1952) and R. Collingwood. R. Ingarden's position, that a musical work is a Husserlian 'intentional object', coming into being at a given historical juncture and dependent upon human activity, is perhaps also an instance of the third view. Finally, though I will not consider it further in this essay, it is possible to take an *eliminativist* view of musical works, denying that there really are any such things, and recognizing only scores, performances, and associated practices.

Musical Work as Class of Performances. The idea that a musical work is a class of performances presents problems that derive directly from the difference between works and performances *simpliciter*. A work that is never performed generates no class of performances, and yet remains an existent work of music none the less. But additionally, if the class with which we are to identify a work is conceived in temporal fashion, then the work expands – grows peculiarly larger – with each performance, whereas if conceived atemporally or eternally, as collecting together all performances past, present, and future – then the work is equally peculiarly revealed as an entity with some arbitrary (e.g. 8721) number of elements or constituents. Furthermore, what it is to hear or aurally experience a class is indeed difficult to say.

Musical Work as Mental Entity. The idea that a musical work is a mental entity or process, existing perhaps in the imagination, also has little to recommend it. It can explain neither the public access we have to musical compositions, nor their capacity to endure long after their creators, and their original interpreters and audiences, have gone the way of all flesh. The appeal of this theory seems largely based on the fact that a musical work can exist as the *object* of thought before being manifested outwardly in any physical act or artefact, and on a confusion between the *experience* of composing, performing, or listening, and *what is then so experienced*, either immediately or mediately.

Properties Constitutive of a Musical Work. Among those who regard a musical work either as equivalent to, or as at least includ-

ing, an abstract sound structure – proponents of the second and third views labelled above – there is some dispute over which properties belong to the sound structure constitutive, in whole or in part, of a musical work. Almost all agree this includes pitches and rhythms (or at least *relations* of pitch and rhythm), but there is not general accord concerning tempo, phrasing, dynamics, timbre, and instrumentation. (Goodman, for his part, has proposed that only strictly notationally expressible properties of a musical composition – i.e. roughly just pitches and rhythms – should be considered definitive of it, but this is highly counterintuitive and contrary to musical practice.) It can be shown, however, that numerous features of standard musical works central from the perspective of criticism in fact only coherently attach to them if *just about all* the above structural properties of music are taken as constitutive of what such works are.

Musical Work as Sound Structure. The idea that a musical work just *is* an abstract sound structure or pattern *tout court* runs into problems, first, having to do with creatability, since abstract structures of pre-existing tonal elements would seem to already exist when the system defining them was given. But second, and more importantly, the differentiation of musical works in terms of the full complex of aesthetic/artistic properties that are generally held to belong to them demands that they be seen as entities more finely individuated, more historically qualified, than sound sequences *per se*. There can be two sound-structurally (and even instrumentally) identical musical works, even within the same musical systems, which possess different such complexes, and thus are strictly distinct. This is due to differing *contexts of origin*, and thus to correspondingly differing contexts of correct performance, audition, and understanding. One response is to regard musical works as *initiated* types: structures-as-indicated-in-a-context, or by-person-*P*-at-time-*t* (Levinson 1980), which are akin to what some philosophers have called '*qua*' objects. Another would be to regard musical works as sound structures *together with* their intended contexts of presentation and appreciation (Walton 1988).

Musical Work as Contextually Qualified Performed-Sound Structure. But finally, it can be argued that *instrumentation* is indeed an integral constituent in the entity which can be identified with a musical work. Shorn of their specific instrumentations – both in terms of timbral quality and of means of production – such works would lose the definiteness of aesthetic character that criticism and ordinary discriminating experience ascribes to them. Thus, a musical work must be seen as having at its core the union of a sound structure and a performing-means structure – as being at base a structure of *performed-sounds*, so to speak. Putting this together with the above, then, a musical work is plausibly a variety of initiated type – a contextually qualified performed-sound structure.

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N

Naïve Physics

Naïve physics is that branch of artificial intelligence research which seeks to fix our everyday, commonsensical knowledge of the external world in a form that is capable of being conveyed to and utilized by a computer. Research in naïve physics originated in reflection of the computational difficulties associated with the use of standard physics as a basis for programming in robotics. The theories of standard physics seem not to address cuts through reality of the right sorts and dimensions to assist in the negotiation of obstacles of the sort we encounter in our (and the robot's) everyday experience.

Different variant forms of the discipline have been advanced. Thus for example there is the work of J. R. Hobbs *et al.* (1987) on the use of common-sense knowledge in the understanding of texts about mechanical devices and their failures, work that is centred on the development of what is explicitly referred to as a 'common-sense metaphysics', amounting to a theory of those core concepts (such as granularity, scales, time, space, causality, etc.) which figure in virtually every domain of enquiry.

There is the 'qualitative physics' of J. D. de Kleer and J. S. Brown (1984). This seeks to provide qualitative algorithms for predicting the behaviour of complex devices from the generic behaviours of their respective components. The latter prove capable of being reduced to a relatively small number of basic types enjoying different realizations in highly disparate fields. Conduits, for example, may be used to convey air, water, electric current, information, and so on. The algorithms themselves rest on the use of a qualitative differential calculus which in some respects recalls the morphological ideas of René Thom.

The term 'naïve physics' itself, however, is associated above all with the work of Patrick Hayes (1985). Hayes envisages a programme of massively large-scale formalization of common-sense knowledge to be expressed in terms of a first-order axiomatic theory embracing of the order of 10^4 to 10^5 predicates. Such predicates may be divided into various sub-clusters, representing tentatively and provisionally distinguishable branches of the discipline of naïve physics taken as a whole. Thus in particular Hayes distinguishes sub-clusters of predicates relating to:

- places and positions
- spaces and objects
- qualities and quantities
- change and time
- energy, effect and motion
- composites and pieces of stuff.

Consider, for example, that sub-cluster which relates to places and positions. This might involve predicates coding notions such as: on, in, at, path, inside, outside, wall, boundary, container, obstacle, barrier, and so on. No one of these notions as realized in naïve physics will be capable of being reduced to any of the others. An adequate treatment of the predicate coding 'on', for example, would need to tie this predicate axiomatically to predicates coding notions such as friction, support, gravity, solidity, tension, load, pressure, and so on, in addition to the purely geometrical component of the notion. Moreover, each of these predicates, too, could be treated adequately only by means of axioms in which they are tied in non-trivial ways to some or all of the others. The theory of naïve physics must therefore be highly non-hierarchical, as contrasted with a system like, say, Rudolf Carnap's *Aufbau*, where a very small number of primitive notions suffices for the construction of the entire edifice of the theory.

Pre-history of Naïve Physics. It is not, at this stage, clear whether naïve physicists are indeed able to provide with their methods a computationally efficient and predictively powerful alternative to standard physics. Their work is interesting, however, already from a *descriptive* point of view. In this respect it echoes back to an earlier sort of physics such as we find, for example, in Aristotle and his followers, and modern-day practitioners in the field have indeed recognized that valuable insights are to be gained from those medieval thinkers, such as John

Buridan and Nicole Oresme, still operating within a broadly Aristotelian framework. (See e.g. Holland *et al.* 1986, p. 208.)

In the works of the medievals, however, the issue is for obvious reasons not addressed as to the proper relation between this (qualitative) physics and (quantitative) physics of the more standard modern sort. Early exponents of what might be called a *sophisticated naïve physics*, which is to say: a theory of the commonsensical domain whose relations to physics proper are made the subject of explicit theoretical concern, were Ernst Mach and Richard Avenarius, who sought a view of the world as this is directly given in the fabric of 'pure perceptions', the latter conceived as having been stripped of those metaphysical ingredients (for example, ideas about absolute space and time) that are customarily imported into experience.

It is in the work of the Gestalt psychologist Wolfgang Köhler (1887–1967), however, that there appears what is perhaps the first occurrence of the term 'naïve physics'. In his *The Mentality of the Apes*, a work whose original German text dates back to 1917, Köhler points out that "psychology has not yet even begun to investigate the physics of ordinary men (*Physik des naiven Menschen*), which from a *purely biological standpoint*, is much more important than the science itself". As Köhler shows:

> not only statics and the function of the lever, but also a great deal more of physics exist in two forms, and the non-scientific form constantly determines our whole behaviour. (With experts, of course, this is saturated in all stages by physical science in the *strict* sense.)

Köhler's ideas, along with those of his fellow Gestalt theorist Max Wertheimer (1880–1943), were then worked out in detail by two Berlin psychologists Otto Lipmann and Hellmuth Bogen in a work entitled *Naive Physik*, published in Leipzig in 1923.

The phenomenologists, too, and above all Edmund Husserl in his *Crisis of European Sciences*, addressed in explicit philosophical fashion the problem of the relation between pre- and post-Galilean physics and the ontology of the common-sense world – called by Husserl the "theory of the structures of the life-world" (cf. Petitot and Smith 1990). A history of naïve physics from Aristotle and the commentators to Hayes and his associates has still, however, to be written.

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BARRY SMITH

Names. See: Singular Terms

Naturalism

Apart from certain uses of this term in ethics, naturalism signifies all those systems for which nature is the whole of reality. By nature is understood, especially in American naturalism, that which is amenable to scientific explanation. This use of 'scientific' to mean *natural* science, common in English-speaking countries, yields, if the qualification is made explicit, a circular definition of nature. Hence there must be added the claim that natural science can explain all there is, at least in principle.

The key idea, however, is that of reality as a monistic system and hence as subject to a uniform method of study. Thus nature, besides signifying all that can exist, has also to be seen as a single process in which all events are connected in a strict determinism – for freedom, it is thought, evades explanation and prediction. Thus nature must form a kind of Spinozistic total event which is given or

'natural' in the sense that no *further* explanation can or should be sought. Questions about reality, to be meaningful, should thus be construed as questions about the current scientific world picture.

Empiricism up to Kant and, later, positivism prepared the soil for this general view of things. Since the 1930s it has replaced idealism in the United States as the dominant philosophy, already sketched in *The Life of Reason* (1906) by George Santayana (1863–1952). Representative were R. W. Sellars, C. I. Lewis (1883–1964) (*Mind and the World Order*, 1929), or, in England, C. D. Broad's (1887–1971) *The Mind and its Place in Nature* (1925), which ends with a plea for "a deliberate modification of human organisms" via eugenics in order to increase human receptiveness to this naturalist view of life. The suggestion illustrates, early on in the movement, the reductivist character of naturalism, not only, as indicated, at the level of explanation but, more drastically, at the level of the assignment of a value independent of the total system of nature to human persons or what they in turn might value.

This illustrates a further general point, that understanding the world and changing it, the two values which Karl Marx (1818–83) set in such dramatic opposition: theory and practice are brought closer together in naturalism than on the classical scheme. It can thus appear as a variant of pragmatism. Hence we find the concept of explanation being regularly expounded in the philosophy of science in terms of 'models' chosen with an eye to needs describable as practical if these can include a need for 'intellectually getting on' (Alan Donagan). Such an attitude easily comes to be adopted even in the faraway sphere of ethics (although Donagan himself, in *The Theory of Morality*, Chicago 1977, retains the Kantian concept of persons as transcending the 'scheme of nature'). It differs markedly from the static classical ideal of increased understanding, which depends upon a realist epistemology difficult to justify on naturalist premisses where the mind is declared no more than a part of the whole it seeks to comprehend. But this does not mean that the naturalist world-view may not still constitute a *theoria* in the old sense, and different positions on that point are taken among the naturalists themselves.

All the same, it must be admitted that naturalism, largely through the influence of John Dewey (1859–1925) upon American public education (*Experience and Nature*, 1925), has at times taken on the quality of a popular ideology comparable with Marxism-Leninism, itself a variety of naturalist monism, in the Soviet Union during the same period. It is thus clear that a certain doctrine of value is intrinsic to naturalism and the ideal of a disinterested science may well come to require that science be freed from what may be judged on balance to be an embarrassing philosophical concomitant. Alternatively, it may be claimed that these more drastic implications of naturalism may be acceptably tempered by extrinsic considerations so that there is no need to abandon the naturalist view *in toto*, since this, it is claimed, would be tantamount to abandoning the scientific project itself.

Much of the more recent naturalist discussion centres upon the brain and the supposed supervenient orders of knowledge and belief. Thus D. Dennett (1978, p. 11) would classify computers, animals, and humans together as 'intentional systems' which have in common a capacity for belief and desire. Such a materialism, however, should be seen as no more than a 'model' within the naturalist dialectic. For as W. V. O. Quine (1953) has conceded, materialism within contemporary science plays in this respect a role on all fours with that of the gods in the Homeric world-view: "Both sorts of entities enter our conception only as cultural posits"; the thrust of "the conceptual scheme of science as a tool" (Quine) remains the urge to a unified conceptual framework such as naturalism and materialism seem most easily able to provide.

There is now much discussion of 'internal realism' (Hilary Putnam's handy phrase), according to which nature is not the whole of reality but the whole of what is open to our mental view, which we thence agree in *calling* reality. But this basically Kantian, if ultimately pragmatist, notion of explanation was already clear in much earlier naturalist writing, such as Wilfrid Sellars's *Science, Perception and Reality*, with its dialectic of the

scientific versus the manifest image of man. Here, once again, use of the term 'image' reflects the pragmatist viewpoint, explanations being judged predominantly in terms of what will serve the search for a monistic paradigm or mirror in which to see our 'image', scientific or manifest. Such a project, however – and the same can be said of Putnam – contradicts, no doubt advisedly, the metaphysical claim of naturalism that nature, as explained by 'science', is the whole of reality. In fact this Kantian or even Lockean conceptualism seems more consistent as a position for naturalists, since naturalism can never yield a realism if realism requires mind to be more than a supervenient epiphenomenon *within* nature, as history would suggest that it does.

Historically, indeed, naturalism, from Thomas Hobbes to Gilbert Ryle's *The Concept of Mind* (1949), embodies the reaction against René Descartes's simplified dualism, which denied all relation between mind and matter, knower and known. At the same time the Cartesian *method* of reductive doubt and his ensuing denial of all but 'clear and distinct ideas' is naturalism's historical root. For naturalism man can have no more than an eminence of degree (it may be a very high degree, however) within nature, evolution being made the agent of his 'emergence'. It is this view, however, which reinforces those theories of mind noted above as being primarily a practical or problem-solving power in the struggle for survival, which raise in turn a problem about the existence of philosophy. For at the same time, as one notices in Ludwig Wittgenstein (e.g. *On Certainty*, on the Cartesian theme), the need for the ultimate or absolute justification of theories is put in question.

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STEPHEN THERON

Natural Kinds, Modern Theories of

The most important modern contribution to our philosophical understanding of natural kinds is due to the (independent) work of Saul Kripke and Hilary Putnam in the 1970s. (See especially Kripke (1972) and Putnam (1975).) Some attention had been paid to natural kinds by analytic philosophers such as W. V. O. Quine, but it is only with the seminal work of Kripke and Putnam that the topic of natural kinds has gained prominence as a special category in analytic philosophy. It is notable that Edwards's *Encyclopedia of Philosophy* (1967) contains no article on natural kinds, nor any entry for natural kinds in the index.

One exception to the modern tendency to ignore natural kinds as a special topic is John Stuart Mill (1806–73). Mill stressed the difference between classes that have one or only a few distinguishing characteristics in common, such as the class of white things, and classes that have an unlimited number of characteristics in common, where we would never expect to plumb the depths of all that distinguishes the class. The latter classes Mill calls 'real kinds' and are what we would call 'natural kinds'. Mill gives as examples of natural kinds the plant and animal species, including human being and chemical types such as sulphur and phosphorus.

Although Mill was careful to distinguish between natural kinds and artificial classes, he seems not to have distinguished between the semantics of natural-kind terms and other general nouns.

Mill says that *all* 'general' names are connotative; such a predicate as 'human being' is defined as the conjunction of certain properties which give necessary and sufficient conditions for humanity – rationality, animality, and certain physical features (Kripke, *Naming and Necessity*, p. 127).

In this respect Mill is consistent with what Kripke calls 'the modern logical tradition, as represented by Frege and Russell . . .' (*Naming and Necessity*, p. 127). In contrast to 'the modern logical tradition', however, Mill holds that proper names are non-connotative. The modern logical tradition seems to hold that Mill was wrong about proper names, but right about general terms. At least for ordinary proper names, such as 'Aristotle', the modern logical tradition holds that proper names are connotative just like general terms.

The importance and revolutionary character of Kripke's and Putnam's ideas is that they reverse the modern logical tradition in that they agree with Mill's view that proper names are non-connotative but reject his claim that all general terms are connotative. In particular, according to the Kripke/Putnam view the semantics of natural-kind terms is similar in crucial ways to the semantics of proper names as construed by Mill.

According to Kripke and Putnam, the similarity between natural-kind terms and proper names is this: that just as a proper name is non-connotative and is a rigid designator of an individual, so a natural-kind term is non-connotative and is a rigid designator of a kind. A term is a rigid designator if it designates the same entity in every possible world in which that entity exists. (Kripke introduced the term 'rigid designator'. His ideas emerged out of his work on the semantics for modal logic and rely heavily on the notion of possible worlds.) The proper name 'Aristotle', when used to talk about other possible worlds, names the same individual as it does in the actual world. When I talk about counterfactual situations using the name 'Aristotle', I mean the same man as I do when I talk about actual situations. For example, if I say that it would have been a terrible loss to humanity if Aristotle had never gone into philosophy, I mean it would have been a loss to humanity if that very man had never gone into philosophy. On the other hand, the description 'the teacher of Alexander' is non-rigid. In some possible worlds it denotes Aristotle, in others someone else.

It should be noted that no (non-trivial) description is synonymous with 'Aristotle'. If I say that Aristotle was a great philosopher of antiquity, a student of Plato, and teacher of Alexander, I am not giving the meaning of the name 'Aristotle'. These are contingent facts about Aristotle and not part of the connotative meaning of 'Aristotle'. I can imagine that none of these things is true of Aristotle. It is not true 'by definition' that Aristotle was a great philosopher. Along with Mill, Kripke would say that a proper name like 'Aristotle' is non-connotative, that is, it has a reference but no necessary and sufficient conditions associated with it by definition.

The claim that natural-kind terms are, like proper names, non-connotative rigid designators has many important ramifications for our understanding of natural kinds and the terms that name them. For one thing, if Kripke and Putnam are right, we should not expect that a natural-kind term has a definition if a definition is understood as giving a connotative meaning (i.e. a non-trivia necessary and sufficient condition for fallin under the term).

That natural-kind terms lack definitions goes against almost all traditional thinking on the subject, but on reflection it is not implausible. Consider the natural-kind term 'gold'. Most of us would say that gold is a yellow metal, but being yellow and being a metal are not part of the sense or meaning of the term 'gold' any more than being a great philosopher is part of the meaning of the name 'Aristotle'. If being yellow and a metal were part of the meaning of 'gold', then the statements 'Gold is yellow' and 'Gold is a metal' would be analytic, but they are not. We can imagine discovering that, although everybody believed that gold is yellow (due to some sort of outlandish mass hallucination), actually some or all of the gold is not yellow. Likewise we can imagine learning of some massive error in chemical theory which made the experts erroneously believe that gold was a metal. In a similar vein, Putnam argues that 'Cats are animals' is not analytic, because we can imagine discovering that all the cats are robots. It should be emphasized that Kripke and Putnam are not suggesting that natural-kind terms are vague or cluster terms. Their view is that the entire meaning/

definition/necessary and sufficient conditions approach to general terms and especially natural-kind terms is misguided. It is more correct to think of natural-kind terms as non-connotative Millian proper names of kinds.

If gold is not 'by definition' a yellow metal, then what is gold? What makes some stuff to be the metal gold is not that it satisfies some definition or descriptive concept that we have of gold. 'Gold' is a rigid designator of a kind of substance, so it names the same kind in every possible world. The substance named by 'gold' is gold in every possible world, no matter what its superficial characteristics are in that world. Presumably, however, there is something that stays the same about gold from possible world to possible world and that accounts for its superficial characteristics. This is the essence of gold. It is what makes gold gold.

According to Kripke and Putnam, what makes gold gold is its atomic number. Assuming that we are right that gold is the element with atomic number 79, then gold is the element with atomic number 79 in every possible world. Stuff that was not atomic number 79 would not be gold, no matter how much it superficially resembles gold. Likewise water is H_2O. Assuming that we are correct that water is H_2O, then it is impossible that there be stuff that is not H_2O but is water. Stuff that was not H_2O could be a water mimic but not water. We do not yet know what makes something a cat but it is probably some feature of its genetic code. And so on for other natural kinds – the essence of the natural kind is an empirically discoverable underlying structure. As Kripke says: "In general, science attempts, by investigating basic structural traits, to find the nature, and thus the essence (in the philosophical sense) of the kind" (*Naming and Necessity*, p. 132). It should be noted that Kripke is not proposing that ordinary definitions be replaced with scientific ones. It is a scientific discovery that gold is atomic number 79, not a definition. It is not analytic that gold is atomic number 79, but it is necessary if true.

How is it that the word 'gold' gets attached to just that particular kind of substance? It is not that someone long ago thought to himself "By 'gold' I mean yellow metal". A more insightful myth of the origin of natural-kind terms would be that we, or rather people long ago, recognized that there were certain natural kinds of things in Mill's sense. In order to introduce a term, e.g. 'gold', they 'baptize' some items that they take to be good samples of the substance. Then the name is handed down from person to person, each one intending to refer to the same kind of stuff that the others were referring to. In this way we get a causal or historical chain. Of course, at the same time people are investigating the nature of the stuff. As the investigations become more scientific, we may discover the underlying structure and sophisticated tests replace superficial properties as indicators of the substance. With such sophistication we may discover that some of the stuff that we originally took to belong to the kind does not and that other stuff that we thought was different is the same because it shares the same underlying structure.

According to this account, the superficial properties that are associated with a natural-kind term, although they do not form part of the meaning, do serve to help fix the reference of the term. When I say that gold is a yellow metal, this helps my hearers know what I am talking about by mentioning readily observable characteristics of the stuff that I mean to refer to by 'gold'. Putnam calls these superficial properties the 'stereotype' of gold. Most common natural-kind terms have associated stereotypes and these are usually known to speakers of the language. Again it should be emphasized that the stereotype does not give a necessary and sufficient condition for falling under the term; it is just a handy guide for picking out what is being referred to. Putnam also emphasizes that although most competent speakers know the stereotypes, we rely on experts for knowledge of the underlying structures.

One important and unresolved issue is how many and which general nouns are natural-kind terms. Kripke seems to have restricted his discussion to the animal, plant, chemical, and physical kinds, but Putnam has claimed that almost every general noun develops a natural-kind sense. Putnam's view seems too

extreme. Though many general nouns are rigid designators of kinds, many others, especially terms for kinds of artefacts, have analytically associated necessary and sufficient conditions. We do not expect scientists to investigate the essence of every kind of thing. There are many kinds of things whose members do not share an underlying structure. Many 'essences' are just purely linguistic. The difficulty is distinguishing between those general terms that have a natural-kind sense and those that fit the traditional Frege/Russell theory,

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STEPHEN P. SCHWARTZ

Natural Law

Natural laws are omnipresent in modern natural science. But it is only in physics that they became the primary goal of research. Kepler's three laws of planetary motion and Galileo's law of free fall mark the new epoch. In spite of recurring attempts to define what a law of nature is, we have no generally accepted definition and presumably never will.

Perhaps the most important single feature of a natural law is that it is *deterministic*. It allows the unique reconstruction of a complete state description of a physical system from this or that small fraction of it. More specifically we distinguish since Newton between:

1. a general law of nature, e.g. Newton's *lex secunda*;
2. a special kind of force, e.g. gravitation; and
3. initial and boundary conditions, e.g. the positions and velocities of the planets.

The latter, together with the special law following from (1) and (2), uniquely and completely determine the behaviour of the system. Determinism proper, as it has become famous through a phrase from Pierre Simon de Laplace (1749–1827), is the extreme case where the state description can be reduced to data concerning one time-point only. The special laws are mathematically expressed by equations having highly characteristic invariance properties. Their determinism results in a host of consequences of the conditional form 'if A then B', where A and B are empirically accessible partial descriptions of the system in question. It is by means of these conditionals that a law becomes capable of experimental testing and allows us to make precise predictions. Frequently (but somewhat misleadingly) the empirical conditionals themselves are represented as the prototype of a natural law.

The threefold, Newtonian structure of a deterministic theory has survived the physical revolution of our century and is still present even in current quantum field theory of elementary particles (action principle – Lagrangian – initial state). It has, however, received two important qualifications: *deterministic chaos* and *quantum theoretical indeterminism*.

The former marks the discovery that most deterministic systems, even classical ones, are extremely sensitive to the slightest change in their initial conditions. Consequently, the predictive force of the corresponding laws is of highly questionable value, and one has to look for regularities in the laws much less informative than their original determinism.

The latter, quantum theoretical indeterminism, brings the irrevocable intrusion of probabilities into the laws of physics. There is even less direct negation of determinism here than in the former case. The Schrödinger equation of quantum mechanics is as good a deterministic equation as one can get. However, this determinateness only holds between the probabilities of measuring this or that value of a physical observable and not, as in the classical case, between these values themselves. This indeterminateness notwithstanding, causal thinking in a wide sense is still alive in even the most advanced high

energy physics. It makes a difference in a scattering experiment what the target is.

With a suitable interpretation of the probability concept, any probability distribution can itself be interpreted as a *statistical law*. It then says with what probability a result will occur if a certain experiment is repeated. The law-like character is particularly evident for transition probabilities of stationary Markoff processes. The special cases of probability 1 and 0 suggest anew the old view that probability-free physical laws, if they are valid, are *necessarily* valid. Such necessity has been claimed particularly for *causal laws*. On the other hand, already David Hume had argued in great detail that necessity, if it can be found at all, can be found only in the experiencing subject and not in the physical processes themselves. Indeed, from an empiricist point of view, the idea that the world could be different from what it is in some respects but not in others is wholly fictitious. For us, then, there is only one world, and the necessity of its laws as distinct from singular propositions may just be falsely suggested by the fact that the latter but not the former, occur in numerous similar variations.

The laws of physics (and presumably of all natural science) can be ordered in a *hierarchy*. Some laws are reducible to (or explained by) others. At the bottom of the hierarchy there are the 'degenerate' cases where laws explain singular facts. In general, the reducing laws are the more comprehensive, in the sense that they introduce more detailed descriptions of already known systems or even of entirely new ones. The direction of the reduction is roughly determined by the composition of matter and by the decrease of the governing forces with increasing distance. The final goal is the reduction of all forces known by experience to as few fundamental interactions as possible. This completion of the hierarchy of its laws could eventually lead to the unity of physics.

"The age in which we live is the age in which we are discovering the fundamental laws of nature" (Feynman 1965, p. 172). However, it may very well be that this age will soon come to an end – even without the fundamental laws. There is growing interest, even on the part of the physicists, for detailed investigation into more and more *complex systems*. The exploration of the hierarchy of natural laws has at least shown how little we know about the world if we know its fundamental laws. Contingencies pervade the derived laws, and their explanatory power decreases with increasing complexity in the systems to which they are applied.

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ERHARD SCHEIBE

Natural Science

Natural science is in this article understood in the post-medieval sense where, almost by definition, questions about intentionality and teleology are excluded. Furthermore, the term is here restricted to those areas of contemporary natural science where physics is regarded as the basic discipline. Ontological questions pertaining to biology and ecology are excluded, too.

Before presenting the central issues around which ontology and natural science meet, some words are needed about the general relationship between philosophy and science. There are, first of all, epistemologies which rule out ontological considerations in the natural sciences (e.g. conventionalism and instrumentalism). But this holds of some ontologies, too. Ontologies saying that nature is an assemblage of unstructured particulars effectively turn the philosophy of the natural sciences into a branch of (say) the philosophy of language, since all structure, then, is linguistic structure. Ontologies affirming that all change is illusion, of course, also render illusory the content of the natural

sciences as well as of the philosophy of the natural sciences.

If one accepts, however, that ontology and natural science are relevant to each other, then three epistemological options seem to be available. One may claim (a) that philosophers can decide about the true ontology without any help from scientists, (b) that scientists can make this decision without any help from philosophers, or (c) that some kind of co-operation is required. Arguments concerning these positions will not be dealt with here. Whatever the true context of justification looks like, ontology and natural science will be taken in what follows to be overlapping disciplines.

The meeting-place for ontology and natural science contains three main areas which we shall call

1. The Stuff of Nature,
2. Space and Time,
and
3. The Causal Connection.

The relationships between issues classified separately under the three groups will here be hinted at only.

The Stuff of Nature. The issue as to what the world is ultimately made of may itself be broken down into five subsidiary questions:

1.1 Is there only one stuff of nature?
1.2 Does everything that exists exist actually?
1.3 Is the stuff of nature definite or indefinite?
1.4 Is the stuff a substance or something else?
1.5 In what way can different kinds of stuff be brought together in space?

1.1 Most ontological positions with regard to the question 'What is the stuff of nature?' were delineated already by the pre-Socratics. Thales (*c.* 624–545 BC), in particular, began to ask questions about the world's origin or original principle (ἀρχή) and its nature (φύσις). Thales, Anaximander (*c.* 610–547/6 BC), and Anaximenes (fl. *c.* 546/45 BC) all claimed that there is but one ultimate stuff. Later, Empedocles (*c.* 490–430 BC) argued that there is a plurality of such ultimate stuffs, and Anaxagoras (*c.* 500–428/7 BC) held that there are infinitely many. This dispute, *the problem of one and many*, has been casting its shadow over natural science ever since. The corpuscularism of Newtonian mechanics tended originally towards the view that there is one kind of atom only; the chemical atomism of John Dalton (1766–1844), however, led 19th-century atomists to adopt a belief in many substances, though never in infinitely many. In modern physics, the theory of general relativity has given new impetus to the belief that there is only one ultimate stuff, an energy field. But the theory itself is only about gravitational interaction. It takes into account neither electromagnetic interaction nor weak and strong interactions, though there have been several attempts to create an all-embracing one-stuff theory (the latest being the theory of superstrings).

1.2 Is everything that exists actual, or does existence have two modalities: actuality and potentiality? Aristotle's ontology recognizes two kinds of ultimate stuff: first, an undifferentiated prime matter which exists only potentially; second, the four fundamental stuffs of the world: earth, water, air, and fire, which exist in actuality. Post-medieval physics has mainly worked only with actual entities, but there are two notable exceptions, one within general relativity and one within quantum mechanics (QM).

The famous equivalence formula ($E=mc^2$) of relativity theory has made it possible to regard mass (formerly a property of particles) as a kind or *form of energy* beside the other forms (kinetic, electromagnetic, etc.). Even particles in themselves may thereby be regarded as merely forms of energy. Everything becomes energy, but there is never any energy without a specific form. Energy in itself has therefore only potential existence. In QM it has been proposed (even by Werner Heisenberg) that some states of affairs, e.g. the orbit of an electron, should be regarded not as actualities but as potentialities.

1.3 The actuality-potentiality problem should not be confused with the definite-indefinite problem. Mostly, it is taken for granted that what (actually) exists has to be of a definite kind and has to have definite

properties. Anaximander's *apeiron*, however, may be interpreted as a fundamental stuff which does not have any definite properties. '*Apeiron*' can mean both infinite and indefinite.

Anaximander's idea has made an unexpected return in the discussions about the interpretation of QM. The dominant interpretation is the so-called Copenhagen interpretation of Niels Bohr (1885–1962) and Heisenberg. Today, however, we must distinguish two interpretations of this interpretation: the epistemological and the ontological one. Heisenberg's uncertainty principle implies that it is impossible simultaneously to measure both position and momentum exactly. According to the epistemological interpretation, Bohr and Heisenberg merely made the positivist point that it is meaningless to speak about what one cannot measure, and so that it is meaningless to ask for the position of an entity when its momentum is being measured and vice versa. According to the ontological interpretation, they claimed that the sub-atomic world *is* such that its entities have neither a definite momentum nor a definite position when no measurements are being made. Before measurements there are neither waves nor particles, there is only something 'indefinite'.

1.4. A fourth ontological discussion concerns the problem of whether the ultimate stuff is substance(s) or process(es) or something else. Most pre-Socratic philosophers – their differences notwithstanding – shared the view that the world ultimately consists of some kind(s) of substance(s). Their chief opponent was Heraclitus (*c.* 540–*c.* 480 BC). According to his view the ultimate stuff is fire, i.e. a ceaseless flux, not a substance retaining its identity through time.

Natural science has mostly been dominated by the view that the ultimate stuff of reality is substantial. Ontologically, both particles and classical (Maxwellian) fields have to be regarded as substances. (Even though a classical field may have to originate from a source particle, it can later on exist in and of itself, retain its identity through time, and be a bearer of properties.) The view that the world is ultimately a process has mostly been defended by philosophers (such as Hegel and A. N. Whitehead), not by physicists. However, parts of modern physics, in particular special relativity, have fostered a third view, a view of a kind which was unknown among philosophers up until David Hume. The world, it is argued (e.g. by Bertrand Russell), is a four-dimensional manifold of *events*. 'Event' should here be taken as a fundamental category not reducible to a change in or state of any substance. There are three main positions with regard to the fourth problem now presented. It might therefore be called the *Substance-Process-Event problem*.

1.5 Still another 'stuff problem' concerns the question how different kinds of substances can be brought together in space. This is often, especially in relation to Aristotle and the Stoics, called the *problem of mixture*. In corpuscular ontologies atoms cannot penetrate each other. In such ontologies, therefore, a mixture of different kinds of substances is necessarily a spatial mosaic – a blend or a juxtaposition – of substances. If, however, we regard fields, e.g. the classical Maxwellian electromagnetic waves, as substances, then we find substances which can mutually penetrate. Two such fields which meet do not collide; they just exist in one and the same place. In the space they jointly occupy, their field strengths are superposed. The fields make up a true mixture, a state of affairs which is regarded by corpuscularism as impossible.

Superposition of fields exemplifies a specific kind of true mixture. Another kind is found in pre-Daltonian chemistry, which assumed the existence of true mixtures in which the substances mixed not merely interpenetrated but were in fact also synthesized into a new kind of substance. In the field case we have quantitative superposition of a property which inheres in all the mixed substances. In the kind of chemistry referred to, we have either emergent properties (i.e. the coming into being of new properties which do not inhere in the unmixed substances) or cases where a property of one of the substances involved dominates the properties of the others (as when, phenomenologically, sugar in a liquid makes the whole liquid sweet).

A very special ontology of substances and mixtures was put forward by Anaxagoras. According to him, every bit of the world is a true mixture of all the different kinds of substances there are in the world. Today, parts of QM and features of the holograph have been used in attempts (D. Bohm, G. F. Chew) to look at the world along Anaxagorian lines. Electromagnetic interference patterns out of which holographs can be made have such a structure that the *whole* holograph can be created out of any *part* of the wave pattern. In a sense, here, every part can be said to contain the whole.

Space and Time. 2.1 With the advent of classical physics in the 16th and 17th century, especially in Newtonian mechanics, there became predominant a *container conception of space*. Space came to be regarded as an empty receptacle containing substances within it. Of course, space cannot be any ordinary container, in that it cannot be limited by anything outside itself, but the containment relation is none the less preserved. Such a space is not an aggregate of smaller spaces; rather, sub-volumes of space exist only as parts of space.

The container conception of space was from the start under attack from two opposing flanks. One was René Descartes's identification of spatial extension and matter, which implies that space and material substance are one and the same. This is an example of a *prime stuff conception of space*. Space itself may be regarded as the fundamental stuff of the world. On the other flank, Leibniz proposed a *relational conception of space*, according to which space is merely a system of relations between fundamental particulars of some kind. Different philosophers have proposed different kinds of fundamental particulars, material as well as spiritual, as a substratum for relational space.

All the three conceptions of space here mentioned have both forerunners in ancient philosophy and are live alternatives within physics today. It should be said, however, that they were not worked out very well before modern times. For instance, it is unclear whether the famous 'void' of Democritus (*c.* 460–*c.* 370 BC) is to be regarded as a substance or as a container space. Titus Lucretius Carus (*c.* 99–55 BC), though, put forward a container conception of space, and Theophrastus (*c.* 372–*c.* 287 BC, Aristotle's successor) a relational conception. To most ancients and medievals, space and time were rather unimportant problems because spatial and temporal relations were regarded as accidental, not essential, characteristics of substances.

In modern times, it has been quite the other way round. Space and time have been deemed important ever since, in the Renaissance, the idea of space as an infinite container began to stir the minds. Today, due to general relativity, there has even been a revival of the prime stuff conception of space. The space-time of this theory has been interpreted (for example by J. A. Wheeler) not as a container whose structure is affected by the masses and fields contained in it; but on the contrary: masses and fields have been regarded as fashioned out of curved empty space.

The last remark shows that the prime stuff conception is sometimes regarded as compatible with the idea of a (structured) void, although in many varieties (e.g. Descartes's ontology) the stuff assumed necessarily excludes a void. The container conception, of course, allows empty space, but it does not entail it. Space may be filled as a contingent fact. According to the aether hypothesis – propounded from Christiaan Huygens (1629–95) to James Clerk Maxwell (1831–79) – container space is filled with an aetherial substance.

In the ontology of time, too, there is an analogue to the controversy between relational and container conceptions of space. Time is in one camp regarded as a system of relations between changes, and in another as something which contains and makes changes possible. According to the latter view, there can be a flow of time even in an otherwise absolutely static world, something which is impossible according to the relational conception. After general relativity there is even a prime stuff conception of (space-) time. Thus there is a three-cornered opposition between a container conception, a relational conception, and a prime stuff conception, with regard to time as well as to space.

2.2 For many materialist philosophers, e.g. the Epicureans, Pierre Gassendi, and John Locke, space is *independent* in the sense that there may be space without things or any other kinds of entities, but there cannot be things if there is no space. Things, or matter generally, are dependent for their existence on space, but space is not dependent for its existence on anything else. In relational conceptions, space is by definition dependent, but in prime stuff conceptions space is almost by definition independent. As was just said, many of those who have a container conception are materialists and claim that space is independent. Two proponents of dependence, however, are Sir Isaac Newton and Kant. Space was Newton's bridge between science and theology. He argued that space is dependent on God, that space is "God's sensorium". According to Kant, on the other hand, space and time are dependent on a "transcendental ego".

2.3 *The singularity problem.* Most natural scientists and philosophers have merely taken it for granted that there is precisely one space and one time. Kant tried to prove that this is necessarily the case. Today, quantum mechanics has given rise to speculations about many spaces. According to the 'many worlds interpretation' (Everett-Wheeler-Graham), the wave function of QM should not be seen as describing different possibilities, but as describing different actual worlds, and so as referring to many different space-times.

2.4 The *container-relationality-prime stuff problem*, the *independence-dependence problem*, as well as the *singularity problem*, are all conceptually distinct from the problem whether space and time are *absolute or relative*. The last issue is as much about motion as about space. To claim, as Newton did, that space is absolute is to claim that space is such that things in it can move not only in relation to each other but also in relation to space itself. To claim, as Ernst Mach (1838–1916) did, that space is relative, is to claim that all motion is necessarily motion between kinds of things. This claim, it is worth noting, is not identical with Leibniz's that space is relational, nor does it in itself imply that space has a relativistic metric. Albert Einstein's (1879–1955) theories are not entailed by Mach's position.

2.5 Two developments in mathematics have deeply affected the old questions as to the *shape, structure*, and *extension* of space and time: the discovery of the non-Euclidean geometries and the development of topology. Questions not dreamt of before have arisen and old ones have taken on a new character. For instance, in some non-Euclidean (spherical) geometries every straight line will, if extended far enough, come back to itself. The question whether space is finite or infinite here loses its meaning. Such a space is closed but unlimited. Also, quite new properties – like intrinsic shape and intrinsic curvature – have entered the discussion.

2.6 Whether Newtonian space and time are independent or not has been a matter of some controversy, but it is quite clear that this space is a container which is singular, absolute, infinite, and Euclidean. Indeed it has still more characteristics: it is *non-causal, homogeneous, isotropic*, and *continuous*.

It seemed more or less self-evident that an empty container space can have no causal efficacy, which means that Newtonian space is non-causal. In general relativity, matters are not that simple. Of course, when the latter theory is interpreted so that space becomes the prime stuff, space can have causal efficacy. But it has been argued that even when a container conception is retained, the non-Euclidean geometry of general relativity makes space into a causal agent which affects the things contained.

When space is regarded as *causal* it easily becomes regarded as *anisotropic*, too; i.e. the causal efficacy is different in different directions. This is the case in general relativity. If we bring in the prime stuff view, the space-time of general relativity is not even homogeneous. Different parts are substantially different; some are space-as-matter, some are space-as-gravitational field. Space becomes *heterogeneous*. In relation to some problems within QM, proposals have even been made to regard space (and time) as *discontinuous*.

2.7 Newtonian time has all the characteristics of Newtonian space described above, except, perhaps, one. It may be open to

argument whether it is anisotropic or isotropic, i.e. whether time has a *directedness* or not. The commonsensical conception that time moves towards the future (which several philosophers have tried to prove) is not reflected anywhere in the natural laws and principles of the original Newtonian mechanics. It makes no difference to these laws whether time moves forwards or backwards, i.e. the time variable '$-t$' may be substituted for the ordinary variable '$+t$'. However, in thermodynamics – which has profitably been placed within the general schema of Newtonian mechanics – this is not true. The second law of thermodynamics says that there is a tendency towards greater entropy (towards more disorder on the molecular level) in the future. In other words, the law says that there are irreversible processes. Whether this necessarily implies that time itself is anisotropic is a matter of debate. Isotropic container time may allow laws which say that there are irreversible processes.

Formerly, it was taken for granted that if time has a directedness this is a direction toward the future. Today, in modern quantum field theory, there are interpretations which entertain the idea that the so-called anti-particles are particles that move backwards in time. What kind of conception of time such processes imply is not easy to say.

In Newtonian mechanics space as well as time is homogeneous, but they were regarded as *heterogeneous with respect to each other*. And they were so regarded quite independently of the problem of whether space is isotropic and time anisotropic. Before special relativity this heterogeneity was only challenged by ontologies holding that space and time are similar in so far as both are mere appearances (often illusory) of an underlying reality. Now, however, it is a physically significant problem to what extent space and time are homogeneous or heterogeneous.

The Causal Connection. 3.1 Since Hume, the outstanding ontological problem with regard to causality has been *the problem whether causality contains necessity or is mere ordered contingency* (correlation). Before modern times this was no problem at all. It was taken for granted that most natural processes are causal and that the cause in some sense necessarily produces an effect. With Galileo, Newton, and the rise of classical physics, mathematics irreversibly entered natural science, a change which had repercussions also for the understanding of causality.

Some familiar mathematically expressed regularities, like Galileo's law of falling bodies, are such that it is hard to give them a causal interpretation; the time of fall does not cause the distance fallen with which it is functionally related. The mathematical relationship represents a *non-causal law*. Mathematics made it possible to do important physics without necessarily being concerned with causes, though, as a matter of fact, all the main figures of classical physics were preoccupied with both causal and non-causal laws.

The split between causal and non-causal laws, however, seems to have had long-term effects. The more physics became mathematically clothed, the less important the concept of causality seemed. Since causality and necessity were thought to be intertwined, it also meant that the question of necessity *in re* was lost from sight. In this way it became rather easy for physicists to subscribe to the positivist idea that all real necessities are *de dicto*, i.e. are effects of language. For natural science, this thesis entails that causality leaves the stage and only correlation remains.

3.2 For a very long time there were two main opposing concepts with which the concept of causality was contrasted: *contingency* and *spontaneity*. Newtonian mechanics came mostly to be interpreted as being inconsistent with both the latter concepts. The world began to look deterministic. In the 19th century, however, a new and third opposing concept appeared, that of *statistical laws*. The second law of thermodynamics was reinterpreted (by Ludwig Boltzmann, 1844–1906) as probabilistic in character; the tendency for entropy to increase was regarded as a greater probability of disorder. Deterministic causation was rivalled by indeterministic causation, and there arose the *problem of determinism and indeterminism*.

With quantum mechanics indeterminism

becomes a major topic for discussion. True, the fundamental laws (the equations describing the temporal development of the state functions) are deterministic in the old-fashioned sense, but these equations do not describe any ordinary measurable quantities. QM is mostly interpreted as merely specifying *probable* values of the measurable magnitudes, and so as being indeterministic.

3.3 In the shift from scholasticism and Aristotelian physics to classical physics, final causation (teleology) was gradually banished from natural science. Causality was reduced to efficient or external causality. Carriers of internal causality or *causa sui*, were no longer regarded as having explanatory force. However, the question remains as to whether all kinds of *causa sui* have to imply final causation. It has, for example, been argued that the Newtonian concept of inertia implicitly presupposes an Aristotelian concept of self-change. According to the first Newtonian law of motion, a body not affected by forces continues *of itself* to move – to change its place – in a straight line with constant velocity. The common interpretation has been to regard uniform motion not as a change but as a *state*. Acceleration, on the other hand, has been regarded as a change, a change explained by external forces. In this way, no place was left for self-change in Newtonian mechanics.

Internal causality has, however, staged a minor come-back. According to the so-called propensity interpretation of quantum mechanics, some sub-atomic arrangements have – in and of themselves – propensities or tendencies to develop in a certain way. Such tendencies are in one sense Aristotelian, but in another not. We have here *probabilistic potency*, an idea quite foreign to both the ancients and the medievals.

3.4 Leaving contingency, indeterministic causation, and internal causation aside, there remains a major problem with efficient causality: *the problem of contiguity*. It is a problem with regard to both space and time. Are cause and effect necessarily spatially contiguous? And are they necessarily temporally contiguous? In both cases two sorts of negative answer are possible. One can oppose contiguity by claiming either that cause and effect can be spatially overlapping or that there is action at a spatial distance. And one may claim either that cause and effect can be simultaneous or that there is action at a temporal distance.

Of these options, only the opposition between action by contact and action at a distance have received any considerable attention within the natural sciences. Newton's law of gravitation, taken at face value, refers to gravitational forces which momentarily connect bodies as far apart as the Earth and the Sun. This law seems to presuppose action at a distance. Newton himself thought a lot about possible causes of the gravitational force. Dissatisfied with the Cartesian idea of push-mechanisms, he looked in other directions, but he found no observable evidence for any specific hypothesis. This is the background for his remark, "I feign no hypotheses".

Like gravitation, magnetic and electrostatic phenomena seemed on the surface to involve action at a distance. But even here the founding fathers (e.g. William Gilbert, 1540–1603, and Charles Augustin de Coulomb, 1736–1806) disliked 'occult qualities'. They speculated or they remained agnostic about the 'true causes' of the phenomena dealt with. The development of the electromagnetic field theories in the 19th century strengthened disbelief in the idea of action at a distance, and it was seemingly given a death-blow by the theories of relativity.

According to the theories of relativity, it is impossible to transport energy faster than light. And, since it is normally assumed that a cause needs energy in order to bring forth its effect, momentary action at a distance becomes an impossibility. Relativity theory is inconsistent with Newtonian mechanics. That fact, however, was only a problem in the period between special relativity and the appearance of general relativity. The latter theory is a gravitational theory without any action at a distance. Problems arose when slowly it was recognized that even quantum mechanics presupposes a kind of action at a distance and is, therefore, in a sense inconsistent with relativity theory.

Today in QM the old *problem of action by*

contact versus action at a distance is framed in terms of *locality* and *non-locality*. A local property is a property of a thing which cannot change due to any kind of action at a distance. In relativity theory all properties are local. A non-local property is a property which can change at a specific instant due to something happening at that very instant at another place. It has been proved (J. S. Bell) that if QM is about determinate properties which, of course, may be affected by measurements, but which none the less can exist independently of measurements, then these properties have to be non-local. If we want to retain locality within QM we have to say that the world is indeterminate (cf. the determinate-indeterminate problem above). It should be stressed, though, that the non-local properties of QM are non-measurable ('hidden') properties. Therefore, the non-locality of QM does not imply that it is possible to transport 'ordinary' energy faster than light.

Problems of the stuff of nature and of the causal connection are here, as in many other cases, closely connected.

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INGVAR JOHANSSON

Nature, Ontology of

Nature-ontology centres upon the issue of what *basic existential* elements make up nature or the natural world, their types and character. Beginning with the Ionion cosmologists, the question 'What is nature?' itself has characteristically been converted into the ontologically oriented question 'What are things actually made of?', or even 'What is the original unchanging substance which underlines all the changes of the natural world?' That set the main historical agenda for answering the key questions concerning what kinds of natural items there are. For in this regard it is often claimed that there are two main traditions in Western philosophy: a dominant *substance* tradition, established by Aristotle, and perhaps obtaining its acme in the varying substance philosophies of the rationalists, René Descartes, Leibniz, and Spinoza, before it was overtaken by further developments in science; and a highly recessive *process* or relational tradition, which has become more conspicuous in recent times, through the work of Henri Bergson and A. N. Whitehead, and through new turns in science.

One important cross-classification of substance philosophies concerns the issue of basic elements: whether these are wholes of some sort, perhaps immaterial wholes as under German idealism, or smallest parts, typically material, as under atomisms (thus too various intermediate and compromise positions between extreme holism and extreme partism). Another major cross-classification of both traditions concerns the extent of the intensionality of components discerned: whether they are purely extensional, like inert particulate matter, or whether some or all exhibit life, sentience, mind, spirit, or other intensional features in an irreducible way (e.g. whether, as on ancient natural science, nature is saturated with or permeated by mind, or not). There is no longer any pressing need to try to answer these and connected questions, for instance as to the intensional hierarchy of substance (now largely an interesting historical exercise). For the idea of substance has largely dropped out of contemporary philosophy (in

favour of such new problematic notions as those of individual, set, and structured particulate matter).

Moreover, this schema of two traditions, though no doubt convenient (like a two-party political system), is too simple. So is the familiar three-period story of European cosmological thought (interestingly detailed by R. G. Collingwood), the high periods being classical Greek, Renaissance, and of course contemporary views of nature. For not only are there other periods of ferment, there have long been *several* different and often competing ontologies of nature, roots of which can mostly be found in early Greek philosophy and myth. The main material philosophy bequeathed to modernity was that of a minor tradition, atomism, where nature is represented as material, particulate, inert, quantitative, mechanical, and reductive. But there were historically several alternatives, many of which offer more ecologically fitting accounts of nature, or contribute environmentally significant ideas. These included Pythagoreanism, with human–animal kinship; Heracliteanism, with a process ontology; pagan naturalism, with a sacred nature; Milesian hylozoism, with a living earth and matter; and later Platonic organicism, with the world a living organism. All these accounts have obtained much subsequent elaboration, for example, organicism in theories from Paracelsus (1493–1541) through to Whitehead and recent Gaia hypotheses.

There is a different dualistic classification which does, however, afford a convenient conspectus upon contemporary positions. For all the renewed emphasis on process and function, the dominant Western view remains some form of mechanism. At bottom this normally now takes a monistic, commonly materialist form (e.g. everything is matter or matter-energy and ultimately explained through physics); otherwise it assumes a pluralistic, many stuff form, typically Cartesian dualism with the two kinds comprising matter and, in ghostly mechanistic tandem therewith, mind. (Of course there are many theories built upon these as to what the interrelations of matter and mind may be, for which see C. D. Broad (1925); and more again, if further different stuffs, such as spirit, are admitted.)

For instance, in mainstream Anglo-American philosophy, which is increasingly mechanistic materialism, nature-ontology has been converted into the issue of what (mainstream) science asserts to exist (in an irreducible way). For *that* is what is supposed to exist – namely, what dominant science says does – and what exists conforms in turn to the laws and has the features assigned to it by science. (The orthodox physicalist version of this is restated by J. J. C. Smart (1989) who wants to argue "that there is nothing in the world over and above the entities of physics, and that everything operates according to the laws of physics" p. 78.) The biggest issues become reductionistic ones, especially those of cognitive philosophy – the elimination of mind and all its intentional manifestations which physicalistic science cannot easily, or at all, accommodate. But outside the materialist mainstream that way of setting up the problems is seen as usurping the issue; mainstream science, to which there are richer options, begs important philosophical questions at issue (such as the pre-reduction character of mind, and mental attributes).

For all that it is tenaciously adhered to, mechanistic materialism has failed and is widely seen to have failed. Setting aside intensionality and mind, it cannot satisfactorily account for all that its reducing science requires and says exists: for the forms that distinguish kinds of aggregations of matter (a problem reaching back to the Ionians), for scientific universals and other theoretical objects, for the nomological cement of this universe, for the objects of advanced mathematics, and so on. All this non-mechanistic ontological luggage it tries to hide under such anaesthetizing covers as 'scientific realism'.

Opposed to mechanism are all those positions based on different images of nature from that of an elaborate machine. Thus appear such supposedly anti-mechanistic images as those of organism, kinship structures, nets and networks, webs, and so on. The new images, many of them lacking substantial intellectual development, and some of them now being notionally rep-

resented through advanced software, have been imported from a range of sources – other non-Western cultures and religions, lesser Western traditions, and new sciences, especially ecology, but also cybernetics and systems theory. The rise of these dissenting positions has been much assisted by the breakdown of Newtonian mechanics as the foundation of science; and several largely programmatic attempts have been made to link them to idealist interpretations of quantum theory.

The new opposition positions are more readily distinguished by what they reject from dominant mechanism than how they themselves are developed and organized. Together they reject many of the old certainties. Above all they repudiate atomistic starting-points, with nature composed of an array of precisely demarcated, clear, distinct and separable individual things, particles or substances, which occupy definite positions in space, and preserve their identity through time, have their own essential natures independently of their relations to anything else, fall into distinct natural kinds, and operate under prediction-enabling deterministic laws (a picture substantially damaged, but not overturned, by quantum theory, chaos theory, and other recent scientific theories). With atomism characteristically goes the removal of holism, wholes reducing to parts; reduction or removal of relations; analysis away of non-local effects; analysis of flux and process into a static (often 4-dimensional) world of things; and so on. So all this normally goes also. Further they take strong exception to attempted reductions to hard science or to physics, reductions which would remove all forms of teleological items and, in a certain sense, life and, under materialism, mind. They also reject deintensionalization, which would eliminate not merely minds, selves, and any more pervasive spirituality, but many or all modalities as well (except in so far as they can be partially simulated through the narrow resources of hard materialist science). And finally they repudiate many of the old rigid thought-patterning ontological divides, classificatory divisions such as subject/object, agent/act, self/other, and so on.

While few of these opposition positions, which now flourish in avant-garde environmental philosophy (e.g. A. Naess 1989), have been made out in requisite intelligible detail, this much is clear about the new nature-ontologies involved. They are highly pluralistic in character. There exist many different irreducible kinds of things in nature. These include not just still surviving species, bioregions, ecosystems, and so on, but also (according, e.g., to Naess's deep ecology) Gestalten, total relational fields, intentional communities, selves and Selves, and so forth.

Between stark materialism, duplicitous dualism, and ecological and spiritual extravagance (which may run to extensive hierarchical levels of being, several of them perhaps transcending nature, however), lie of course more plausible intermediate positions, ontologically admitting certain wholes and maybe certain sorts of spirituality. But further, outside this conventional setting, are other very different alternatives, which distinguish among objects recognized or comprehended to classes: those that exist and so are included in the ontology, and those that do not. The extensive latter class typically includes not merely fictional and purely future objects, but as well abstract and purely theoretical objects. It may also include those non-physical and spiritual items that are comprehended, as well as various often miscategorized items. For example, such natural items as events and processes are of the wrong category to exist; they take place alright, but do not (significantly) exist, whence they are not part of the relevant nature-ontology. Among such alternatives – which explode a crucial ontological assumption upon which received classifications of nature-ontologies rest – are not only more authentic object-theories but commonplace common sense.

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RICHARD SYLVAN

Necessity. See: Inevitability; Modalities, Ontological.

Nelson, Leonard

Leonard Nelson, German neo-Kantian philosopher, was born in Berlin in 1882, and taught from 1909 at Göttingen where he died in 1927. He worked both in theoretical and in moral philosophy.

In his theoretical work, Nelson attempted to establish a rigorous, scientific foundation for philosophy; he took as his starting-point the methodological interpretation of Kant's *Critique of Pure Reason* advanced by Jakob Friedrich Fries (1773–1843). Nelson (who wrote his dissertation on Fries, and who edited the *Abhandlungen der Fries'schen Schule*), attempted to develop a philosophy, based on a critique of reason, that would steer a middle course between transcendentalism and psychologism. He denied the possibility of a theory of knowledge that could prove the objective validity of cognition. Instead, he used the *regressive method* of analysing our knowledge (taken as a *datum*) into its component parts; the aim was to discover and exhibit the synthetic *a priori* metaphysical principles *P* on which our knowledge rests. These principles can be established, Nelson held, only on the basis of non-intuitive, immediate knowledge – hence, Nelson argued, on the premiss of "reason's faith in itself". He invoked this premiss in the 'psychological deduction' of *P* – i.e. in the proof that *P* possesses the unity and necessity characteristic of genuine metaphysical principles. Nelson also wrote on the philosophy of mathematics; specifically, on non-Euclidean geometry, on the set-theoretical paradoxes, and on David Hilbert's axiomatic method. (Hilbert was a colleague and close friend of Nelson.)

In his ethical philosophy, Nelson sought to find the supreme *a priori* principles of morality. From two basic principles – roughly:

1. the requirement that all interests (whether one's own or another's) influenced by one's own deeds receive equal consideration; and
2. the ideal of living one's life according to the standards of the true, the beautiful, and the good

– he attempted to derive, with strict logical rigour, a complete system of philosophical ethics. His system lays great emphasis on the universality of ethical judgements, and his formal analysis of the structure of moral reasoning contains many anticipations of the moral theory of R. M. Hare.

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WILLIAM EWALD

Neo-Kantianism

Kantian thought exerted an influence throughout the 19th century. In Germany it became prominent especially during the period after 1848. Kantianism advocated a neutral *Weltanschauung*, based itself on epistemology, and was sceptical towards metaphysics. Kant's thought made itself felt outside Germany also, and in France (Charles Renouvier) and in Italy (Carlo Cantoni and others) genuine neo-Kantian tendencies appeared. However, a philosophical renewal based on Kant occurred only in Germany, where it coincided with the founding of the 'second' Reich (1871). Here the Kantian movement eventually split into several directions and was partly institutionalized into the different schools of 'Marburg' and 'South-west German' neo-Kantianism.

The movement was initiated by a number of individuals who were in 1871 just 30 years old or less, above all Otto Liebmann (1840–1912), Hermann Cohen (1842–1918), Alois Riehl (1844–1924), and Wilhelm Windelband (1848–1915). Their publications reveal no

unified position, due partly to the fact that the young Kantians came from different philosophical backgrounds. Liebmann and Windelband were students of Kuno Fischer (1824–1907), a professor in Jena whose interpretation of Kant bears strongly idealistic tendencies; Riehl and Cohen had been educated in psychology and were both greatly interested in science.

In spite of the differences, a common direction can be identified: a shared anti-naturalism and anti-materialism; and an antipathy to pessimism and to the intellectual paternalism of the Church coupled with a defence of the ideal of civil liberty.

Hermann Cohen, already early on interested in an 'idealism in science', developed a 'critical idealism' as a basis for epistemology and ethics, and this eventually became the *Leitmotiv* of the Marburg School. In particular he took up the critique of materialism previously articulated in the famous *History of Materialism* (1866, 2nd ed., 1873–5) of Friedrich Albert Lange (1828–75). Cohen, however, argued for a strictly epistemological foundation of ethics, a rigorously logical treatment of the ideas of reason, rather than a poetic one of the sort favoured by Lange. Cohen here utilized a reinterpretation of Plato's theory of forms, seeing his 'ideas' merely as instruments of knowledge and not as independently existing entities. This non-metaphysical employment of Plato was made possible by Hermann Lotze's assertion that the so-called 'being' of Plato's ideas signifies nothing but 'truth-value'. Lotze's claim concerning validity or *Geltung* became one foundation stone of the conception of logic and philosophy in 'South-west German neo-Kantianism'.

The Marburg and South-west German Schools shared a critical idealism and were thus opposed to the critical realism advocated among others by Riehl. The critical realists' attempt to present Kant's critical philosophy in a modern form is characterized by an appreciation of the tradition and claims of empiricism. Scientific knowledge is hereby analysed not solely in terms of its rational *a priori* components, but rather in light of its 'real' elements, which represent the given. Riehl's realistic interpretation of Kant led to the critical realism of Oswald Külpe (1862–1915).

Since the 1920s neo-Kantianism has been presented as having been composed of *two* schools. The most famous members of the Marburg School are Cohen, Paul Natorp (1854–1924), and the early Ernst Cassirer (1874–1945). Their doctrine was explicitly claimed to be true Kantianism, though after the turn of the century they integrated also elements of Leibniz's philosophy. The South-west German School is represented by Windelband, Heinrich Rickert (1863–1936), and Emil Lask (1875–1915).

The Marburg School. Hermann Cohen's epistemological conception arose out of his interpretation of Kant. He was concerned not only with reconstructing Kant's doctrine of *a priori* knowledge, but also with rendering this doctrine useful for a modern theory of knowledge. Early neo-Kantians such as Hermann von Helmholtz (1821–94) and F. A. Lange had interpreted Kant's *a priori*, which serves as a basis for our knowledge of appearances, as a hereditary natural disposition intrinsic to the human species. Cohen, on the other hand, worked out a transcendental meaning of *a priori*: his book *Kants Theorie der Erfahrung* (2nd ed., 1885) describes and justifies the *a priori* conditions of the possibility of experience solely by a logical analysis of mathematics and pure science; the theory of experience as a theory of a 'mathematical science' attempts to demonstrate that the basic concepts and principles of science are the necessary conditions of scientific certainty and validity. Philosophical investigation thus proceeds via a transcendental method.

Cohen's interpretation here goes beyond Kant. Kant had distinguished between the question of the possibility of non-empirical principles (and thus of synthetic judgements *a priori*) in mathematics and in science on the one hand and the question of the possibility of a rigorous metaphysics on the other. Cohen, in contrast, merely raises the question of the reason for the possibility or validity of a 'mathematical science'. Metaphysics means nothing to him but the problem of the possibility of scientific experience. A second point of departure from Kant

is Cohen's practice of treating only the *form* of experience. The intuitive material component is either bracketed out or gets submerged in a determination of the form of experience. Cohen devoted much effort to construing sensation (the intuitive material component of experience) as *a priori*. He commenced this task with an analysis of infinitesimals (1883), going on in his *Logik der reinen Erkenntnis* (1902) to prove, as he saw it, that all determinations of being are products of pure thought. Thinking he sees as the origin of all knowledge; it expresses itself in a system of methods which generate objects ('judgements'). Thus the problem of sensation is assigned to the sphere of the modal 'judgement of actuality'.

This conception of logic as relating to 'pure thought' marks the original position of critical idealism, a position that is distinct from all forms of speculative idealism, which constructs systems of rational knowledge out of a principle or set of principles or which admit the self-explication of absolute knowledge. Its goal is also distinct from that of analytic philosophy of science, which seeks to provide formal criteria for the evaluation of pre-given scientific statements. Cohen's logic of pure knowledge implies on the one hand a critique of materialism and empiricism, and on the other hand a critique of religious metaphysics; the constructive goal is to prove the idealistic nature of science. Cohen aims at a de-ontologized philosophical conception of knowledge and science.

The epistemological thought of Paul Natorp was for a long time overshadowed by that of Cohen, his colleague and friend in Marburg. Natorp, too, worked on establishing a critical idealism and went through the same 'logicistic' transformation as Cohen, though not without some reservations. The problem of the 'given' played for him a lesser role than it did for Cohen. Natorp's *Philosophie* (1911) displays a broad cultural and philosophical background. It assumes the same rationality for all domains of culture, a comprehensive law, which is neither merely scientific nor merely practical. Natorp aims at a higher-order logic of reason, within which the peculiarities of the different cultural domains could be developed logically out of the underlying 'original unity of the law'. Theoretical philosophy is then characterized by its reference to a spatio-temporal, causally conditioned lawful order, while an unconditioned lawful order comprises the object of ethics.

Central to Natorp's epistemology is his concept of *synthetic unity* or of the underlying relational structure of knowledge. This, he holds, serves as the foundation of knowledge, in virtue of the fact that it is possible to unfold out of it the *a priori* elements of knowledge (categories). The system of 'basic logical functions' which is developed in the process yields the elements which are the building blocks of concepts and judgements. The object is the correlate of the original synthetic unity of thought; space and time, as the 'conditions of the determination of existence', function as the final determination of the object as something unique (a view which recalls Cohen's conception of the thing in itself as an idea, in the sense of a limiting concept, which outlines the progressive dynamics of the process of knowledge). Natorp has no logical doctrine of principles which would seek a foundation of the original law independently of its function in the endless process of knowledge. The rationality of science manifests itself not in the proof that all knowledge originates from pure thought, but rather in the logical foundation of the exact sciences.

The South-west German School. The South-west German School, too, seeks to further the critical philosophy of Kant. A significant difference from the Marburg School results from Windelband's development of a transcendental philosophy of value. The grounding of a philosophical system in a system of 'universally valid values' begins with an interpretation of the theoretical as value-laden. 'True' and 'false' are predicates of valuation, which do not increase the content of knowledge but rather express approval or disapproval. Windelband does not represent any objectivism of value; values are based always on valuations and thus on a valuing consciousness.

With Heinrich Rickert it becomes even more evident that epistemology distinguishes itself from the disciplines which deal with

beings, thanks to its orientation toward the concept of value. Knowing and judging imply an attitude towards a value, i.e. affirmation or negation. This attitude belongs not to the representational content of the judgement, but rather to its form. The concentration on problems of form arises out of the rejection of the representational theory of knowledge. The truth of a judgement is founded in the connection between form and affirmation. The judgement is thus relegated to the normative sphere: its truth demands acceptance.

Rickert describes two paths for epistemology: the transcendental-*psychological*, which assumes real acts of knowledge of judgement, and the transcendental-*logical*, which takes the reality of a true sentence as its point of departure (1909). The latter approach is favoured by Emil Lask, who no longer relies primarily on judgement. Instead he describes theoretical validity in terms of a doctrine of categories, which is constructed on the basis of the functional relation of the form and the material of a judgement.

The concept of value assumes a key significance also in the theory of the humanities. In the idiographic 'sciences of events', as they are labelled by Windelband, the relevant facts are selected on the basis of criteria of universally relevant values. According to Rickert, the historian forms his objects by using the principle of selection of cultural values. His method is based on a reference to value (it is *wertbeziehend*); that, however, does not mean that the historian himself passes value judgements. 'Theoretical reference to value' – as contrasted with practical valuation – belongs rather to the realm of fact finding; the historian concerns himself only with facts, from which he selects whatever possesses a cultural value in virtue of the factual valuations of subjects.

Epilogue. It is controversial whether Cohen inaugurated a theological metaphysics in his late *Religion der Vernunft aus den Quellen des Judentums* (1919), where he holds that religion has a specific nature of its own owing to its emphasis on the correlation between the sinful individual and the unique God. Natorp's later philosophy accentuates the idea of unity by including in his metaphysics elements of the mysticism of Meister Eckhart (*c.* 1260–1327). In general the 'critical' debates and theories ceased to provide the focus of philosophy after World War I. Kant was increasingly understood as a metaphysician. Heinz Heimsoeth (1886–1975), a former member of the Marburg School, contributed to this development in no small way; it was he who as early as 1914 opposed Cassirer's interpretation of Leibniz on the grounds that Leibniz's ontology takes precedence over his epistemology.

Motivated by a concern for 'reality' – of the so-called 'external world' as well as of human subjectivity – Rickert and some younger neo-Kantians continued the 'critical' discussion. They did so partly in opposition to contemporary trends, especially existentialism and *Lebensphilosophie*, partly in adjusting to them. Rickert realized that a theory of consciousness could not adequately deal with existentialism; it was necessary to refer in addition to the objective validity of the world of value. An exact determination of the relationship between 'objective validity' and its subjective apprehension seemed to the more recent neo-Kantians to be worthy of a fresh philosophical effort. In this context Richard Hönigswald (1875–1947) attempted to reconcile psychology, which had again become philosophical in its methodological foundations, and critical philosophy; he labelled his project "Psychology of thought" (*Denkpsychologie* 1921). Jonas Cohn (1869–1947) presented a *Theorie der Dialektik* (1923) based on an '*Utraquismus*', i.e. on a conception of the equally original nature of both the form of thought and the content that is relatively alien to it. Cohn's thinking is marked also by a respect for the 'positive', that is by an assertion of the impossibility of deriving the given from the form of thought.

National Socialism and World War II marked an almost complete end of the further development of neo-Kantian thought. Exceptions are provided by the work of Wolfgang Cramer, who makes the transition from an ontology of the ego to a theory of the absolute and its self-externalization; and by Hans Wagner, whose *Philosophie der Reflexion* (1959) connects a critical theory of subjectivity with a speculative theory of principles.

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Neoplatonism

Neoplatonism was the dominant philosophy from the 3rd century AD to the end of classical antiquity, and continued to be a powerful influence on Jewish, Christian, and Islamic thought during the Middle Ages and to a lesser extent thereafter. The term groups together a number of philosophers who had certain views in common, but whose systems were by no means identical. 'Neoplatonism' itself is a modern term: all the Neoplatonists thought of themselves, however misguidedly, as followers of Plato himself. They took from Plato the opposition between a physical world which exists only in a limited sense, and a truly existent intelligible universe which they elaborated to degrees of complexity which Plato himself would never have recognized. At the same time their thought contained important Aristotelian elements, notably much of his psychology, which was put to various purposes and, after Plotinus, his theory of categories.

Plotinus. The first and greatest of the Neoplatonists was Plotinus (*c.* 205–70), whose importance was recognized by his successors even when they disagreed with some of his doctrines. The main outlines of the system were those he laid down in the *Enneads*. He divided the intelligible universe into three levels, Soul, Intellect, and a transcendent One.

The One. This One is sometimes called the Good, after the Form of the Good in Plato, with which it was held to be identical. Here as elsewhere Neoplatonism is based on what has been called a 'hypermetaphysical' reading of Plato. Plotinus's supreme principle could only be described by the negation of descriptions applicable to Intellect, or by the use of terms like 'above-being'. Though strictly ineffable, it could, however, be known by direct apprehension. For Plotinus this took the form of a mystic vision: for later Neoplatonists it seems to have remained a theoretical *desideratum*. Though the One was the source of all subsequent existence, and identified by some religious Platonists with God, for Plotinus it took no interest in things other than itself. It was responsible for their being, not by an act of will but as the automatic result of the plenitude of its infinite power. Plotinus sometimes describes the emergence of the rest of the universe, which for him exists eternally, in metaphors involving the notions of springs, sources, and outflowing. Thus this emergence has come to be thought of as 'emanation'. It should be stressed, however, that this is only one of several descriptions Plotinus uses, and not the most common.

Intellect and Soul. Both Intellect and Soul are the product of a process by which they proceed as an, as yet, unformed 'pre-entity' from the One and Intellect respectively. Both Intellect and Soul then assume their own form by reverting in contemplation to the hypostasis from which they came, a process later described by the terms 'rest', 'procession', and 'return'. This process depends in part on the Aristotelian notion that what thinks is identical with the object of its thought, but here the identity is an incomplete one, so that each level is an imperfect representation of the one above. Nevertheless Intellect can be reidentified with the One, and Soul with Intellect, by further acts of contemplation. The identity of thought and

thinker which exists between hypostases also governs the identity of the constituents of Intellect and Soul, both with each other and with the whole of the hypostasis of which they are 'parts'.

The three levels of intelligible being, or hypostases, differ from each other by the greater diffusion that attends increasing distance from the One, in which everything that later comes to be pre-exists in complete unity. The contents of Intellect are the Platonic Forms, which may also be thought of as intellects, while its eternal self-thinking is that of Aristotle's unmoved mover: in making the Forms the objects of its thought, Plotinus was following an earlier Platonist tradition. Whether these Forms were all species-Forms as in Plato, or included Forms of individuals, at least of individual humans, remains controversial: Plotinus may have left the question open, while later Neoplatonists returned to the orthodox Platonic position.

Intellect. At the level of Intellect things exist as a unity in diversity: at that of Soul they are a diversity in unity, in other words less closely united than in the self-thinking of the second hypostasis. Similarly Intellect is eternally at rest, above process and transition, which are possible ways of moving from one to another of the contents of Soul. Sometimes, however, Intellect and Soul are each described in ways more appropriate to the other. This highlights the philosophical difficulty of distinguishing between immaterial entities which, Plotinus and later Neoplatonists would sometimes say, were distinguished, both from each other and from the One, by otherness alone. Such difficulties may have caused Plotinus's pupil Porphyry to remove or blur the boundary between Soul and Intellect.

Soul. Soul is responsible, through the world soul and the individual souls coordinate with it, for the governance of the physical world. Sometimes this is seen as governance from above, while at others all the intelligible levels are thought of as existing within the individual. Which of them we identify with depends simply on the level at which we focus our attention, and if we successfully direct it upwards we may unite, at least temporarily, with the One itself. For Plotinus this procedure was, except at the final stages, a purely intellectual one, facilitated by the fact that he regarded the highest part of our soul as permanently located in the intelligible, whether it was to be found at the level of Soul or Intellect. This doctrine was abandoned by almost all the Neoplatonists from Iamblichus (*c.* 245–*c.* 330) onwards: they resorted to other means of achieving that ascent to the divine which remained for all of them the purpose of the philosophic life.

Porphyry and Late Neoplatonism. Porphyry, who edited Plotinus's works, was also the first of the major Neoplatonists to engage in philosophical scholarship, which later became the primary vehicle for the expression of their philosophy, a tendency already manifest in the Platonic commentaries of Proclus and even more marked in the Aristotelian commentaries produced by such figures as Ammonius (late 5th–early 6th century) at Alexandria and his pupils Asclepius, Simplicius (fl. *c.* 530), and John Philoponus (fl. *c.* 529).

The Intelligible Universe in Late Neoplatonism. All these figures produced variations of that later form of Neoplatonism which can be traced to Iamblichus, but is codified for us in the works of Proclus. In it the system became more rigid, with the relatively fluid Plotinian boundaries between hypostases being replaced by a large number of additional entities produced by hypostatizing the various aspects of the original levels of being, and attempting to bridge all gaps by establishing intermediates whose identity was characterized by different levels of participation. The clearest exposition of this kind of Neoplatonism is to be found in Proclus's *Elements of Theology*, which sets out both a system and the arguments by which it is established. Here we have an intellect which is unparticipated, another which both participates and is participated in (by others), and a third which merely participates: souls are multiplied in a similar way, and there is even a plurality of Ones, called henads, to stand at the head of separate chains of being. All these, as well as horizontal triads like Life, Thought, and Being, which some have traced back to Plotinus himself, were found in the

text of Plato. Even greater levels of complexity were reached by Damascius (late 5th century–*c.* 540), the last head of the Athenian group of Neoplatonists.

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Neo-Scholasticism

This term appears to have been coined by Maurice de Wulf (1867–1947) of the Institut Supérieur at Louvain, founded by Cardinal Mercier in 1893. It appears in de Wulf's book *Scholasticism Old and New* (1907), eighty years or more after the start of the Thomistic 'revival'. The notion of the *philosophia perennis* as a common body of philosophical doctrine, thought to be almost perfectly articulated by Thomas Aquinas but yet shared by the other Scholastics, caused de Wulf to apply the term 'neo-Scholasticism' to what was exclusively intended as a revived Thomism, the rival systems of John Duns Scotus, Francisco Suárez, and others having been relatively ignored. In proportion as this was understood, the term 'neo-Thomist' was preferred. For de Wulf himself the significance of the prefix was to set apart the new Scholastics as ones who had abandoned outmoded cosmological notions.

It was the historical research set in train by neo-Scholasticism itself (e.g. by Martin Grabmann's *Die Geschichte der scholastischen Methode*, Freiburg, 1909–11) which led increasingly by 1930 to a more subtle nuancing of this view of the *philosophia perennis*, but not to its essential abandonment (cf. Etienne Gilson's *The Unity of Philosophical Experience*). Tradition in philosophy is now viewed more flexibly, but as an idea it remains part of the patrimony of this school, and the importance of Aquinas continues to outshine that of his scholastic rivals, this being as much cause as result of the papacy's patronage of his thought.

It is usual to date this patronage, and the supposed revival of Thomism, from Leo XIII's encyclical *Aeterni Patris* (1879). But history does not entirely support this picture of a 'third' Scholasticism reviving a past epoch. In Spain the tradition had been continuous, and even Protestantism in Germany did not stop its course (Thomasius, Leibniz, Wolff). During the period of the Enlightenment itself, the Dominicans regularly decreed adherence to the doctrine of Thomas Aquinas. S. Roselli wrote his six-volume *Summa Philosophiae* in 1777 and the *Philosophia juxta D. Thomae Dogmata* (Milan, 1676) by Anton Goudin (1639–95) had gone through fourteen editions by 1744. In 1879, with Vatican I's decree *Dei Filius* (1870) on faith and reason behind him, Leo XIII was just confirming what in large part had long been going on when he identified Thomism with a Christian philosophy having its roots in Patristic tradition. His intention was but to restore (*instauranda*) its effective teaching in the schools.

The idea of a philosophical tradition, ably defended by Gilson and present already in Plato (cf. Joseph Pieper, *Über die platonischen Mythen*, Munich, 1965), had been widely discredited by the new Cartesian ideal of a freedom from all influence for the individual thinker. In fact the support of tradition's guardians for a revived Scholasticism can seem at times to cast doubt upon its inner dynamism (hence Jacques Maritain's protest, "I am neither a neo- nor a palaeo-Thomist, but a Thomist"). De Wulf's prefix has become pejorative, and even an end to neo-Scholasticism is proclaimed, while Karl Rahner (1904–84) would dismiss it as a semi-political product of 19th-century romanticism with which the looser contemporary adaptations of Scholasticism (such as his own *Spirit in the World*, 1939) have little in common.

However, such accommodations of Thomism to Kant or Martin Heidegger or others, whether by Rahner, Franz Brentano (1838–1917), Joseph Maréchal (1878–1944), or Bernard Lonergan ((1904–85) *Insight*, 1957) and his supporters, often demonstrably

distort Aquinas and are not self-evidently better philosophy than the purer or more deliberately dependent Thomism of Etienne Gilson, Gallus Manser (1866–1950) or Cornelius Fabro, Norbert del Prado or Reginald Garrigou-Lagrange (1877–1964), however much better they may satisfy a clerical wish for 'dialogue with moderns'. Grabmann himself (1935) knew nothing of such an end to neo-Scholasticism, to which he was busy giving an improved historical sense.

For, of course, no one in the 19th century could have a 20th-century historical awareness. The themes of metaphysics are anyhow independent of and weightier than historical fluctuations, and so are sufficient to vouchsafe continuity. Thus Joseph M. Bocheński speaks merely of "the Thomistic (also called 'neo-Thomistic') school", which is so far from having come to an end that "no other philosophical group seems to have so many thinkers in its ranks or so many centres of study at its disposal" (*Contemporary European Philosophy*, 1947). In the years since this judgement was made, however, such a 'pure' Thomism has come to many to seem the sole opponent to the consensus of pragmatism or relativism.

What previously typified the neo-scholastic movement, however, which arose, at least in Italy, in opposition to traditionalism and ontologism, was an emphasis upon philosophy rather than upon theology, when compared with earlier Scholasticism. Thus Leo XIII called the theologian Joseph Kleutgen (1811–83) the prince of *philosophers*, and Pius X complained of those who "deride and heedlessly despise scholastic *philosophy*" (1907, author's emphasis), declaring later that by this he meant "the principal teachings of St. Thomas Aquinas". In 1914 the Sacred Congregation for Studies put forward twenty-four Thomistic theses to be held and taught in Catholic institutes, twenty-three of which were contrary to Suárez's views, and in 1917 the 'method, doctrine and principles' of Aquinas were imposed in canon law. "The Church has adopted his philosophy for her very own", declared Pius XI (*Studiorum Ducem*, 1923), a position confirmed by Pius XII in 1951 (*Humani Generis*).

If the neo-Scholastics prior to Gilson (*On Being and Some Philosophers*, Toronto, 1952) and his contemporaries tended not to see the 'existentialist' element in Aquinas's thought, the theorists of the later hermeneutic and related schools, on the other hand, have perhaps too readily assumed the meaningfulness of subjecting the texts of Aquinas to 'reinterpretation' according to hermeneutic or historicist principles (Rahner's *Spirit in the World*, again; cf. criticism of this in R. M. Burns (1988)), although this is in direct conflict with Aquinas's own realist, and supra-historicist, theory of truth.

Closely connected with the topic of neo-Scholasticism is the question of Christian philosophy, an idea discussed since the 1930s. If there is such a single Christian philosophy extending back into Patristic times and still living today it seems it could only be Scholasticism. Such a view would require stressing the continuity of Augustinianism and hence neo-Platonism with Thomism and the persistence of the latter into the baroque period and beyond, including rationalists and empiricists as one-sided outgrowths ignorant of their own roots. Gilson's historical work seems here confirmed by Alasdair McIntyre's researches into the fate of the *ethical* tradition in the 18th century (*After Virtue*, London, 1981).

In such a perspective the weakness of the rationalist alternative offered by the Enlightenment can appear to have been just its lack of such a historical continuity. The Ciceronian and Augustinian theory of law as a participation in the eternal law had even supplied a reason for expecting continuous human tradition to be somehow normative.

For these reasons the strength of Scholasticism today, with or without the 'neo', appears in its being a school with more universalistic pretensions than those named after individual men or systems. That it repeatedly distils itself into the cult of one man's work (Thomism) is an accidental consequence of the apparent excellence of that one man. His formulations were bound to have become more or less normative, needing not so much to be 'reinterpreted' by each age (as if his texts were sacred) as to be first understood and then, where possible, amplified.

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Newton, Isaac

Isaac Newton (born Woolsthorpe, 1642; died London, 1727) was the central figure in that complex set of intellectual changes and developments we have come to call the scientific revolution. His work in mechanics, the *Principia Mathematica Naturalis Philosophiae* (1687), initiated a fruitful two centuries of achievement in all areas of the physical sciences, the 'Newtonian' era, as it is often described. His other major published work, the *Opticks* (1704), brought together the experimental and theoretical research on light that had first brought him fame as a young professor in Cambridge; in an imaginative set of appended "Queries", where the tight bounds of deduction and experimental proof were laid aside, he suggested themes that would shape chemistry and the theory of heat for a century. His contribution to pure mathematics was immense; the modern edition of his collected papers on mathematics runs to a bulky eight volumes. His best-known achievement in that domain was the perfecting of the infinitesimal calculus, for which Leibniz also must share the credit. (A bitter priority dispute between these two great men was only one of the many occasions when Newton engaged in acrimonious challenge.) It has only been in recent decades that Newton's work in two other areas has come in for serious attention from scholars. He was actively engaged in practical alchemy over many years, not only spending long hours in what we would now call chemical experiment but also delving in the esoteric treatises of a tradition that had already been all but abandoned by the practitioners of the 'new science'. In addition, he wrote extensively on theology, drawing on the Fathers of the Church as well as the theologians of his own day. He sent virtually none of this work for publication, presumably for the reason that much of it would have been regarded as heretical by the ruling Anglican Church. Newton rejected the doctrines of the Trinity and of the divinity of Christ, and wrote hundreds of pages of detailed analysis of the historical source materials in an effort to show where the Christian Church had gone wrong in the 4th century.

Newton's insistence that hypotheses "whether metaphysical or physical" ought to have no place in "experimental philosophy" (i.e. natural science) has often led him to be characterized as a forerunner of modern positivism. It is true that he admitted only two sorts of inference in experimental philosophy, where "propositions are deduced from phenomena, and afterwards made general by induction". But, in practice, he makes extensive use of hypothesis throughout his work, especially in his optical theories. His reluctance to allow hypothesis in science proper was rooted in part in his early scepticism about untestable hypothesis of the Cartesian sort and in part in a deep-rooted personal inability to deal with the sort of controversy that goes with the justifying of one hypothesis over another. Further, he had discovered that in mechanics, at least, he could produce a very successful predictive account without ever having to deal with the 'physical' issue as to what the *cause* of gravity actually is. The impact of his constricted views on method on later science was considerable; the notion that science consists simply of law-like generalizations derived directly by induction from observable behaviour was not successfully challenged until hypothetical explanation in terms of underlying structures eventually attained legitimacy in 19th-century chemistry and physics.

Newton's account of force led him to infer that there must be an absolute space and an absolute time defining an 'absolute' motion, i.e. a motion such that a change in it entails

the operation of a real force. Space and time are both infinite in extent; neither is dependent on matter. God created matter at a finite time in the past, in the form of imperceptibly small solid particles. It would be "unphilosophical", Newton insists, to suppose that the operation of the laws of nature alone could have brought our ordered universe out of an initial chaos (as René Descartes had proposed). Instead, God would have had to be constantly active, "more able by his will to move the bodies within his boundless uniform sensorium . . . then we are by our will to move the parts of our own bodies" (*Opticks*, Q.31). Matter itself must, then, be entirely passive, unable to initiate motion on its own account.

This leaves Newton in a quandary in regard to the central explanatory concept of the *Principia*, gravitation. He *says* that the Sun attracts the planets: but how can this be, if matter is passive? And even if matter were capable of action, would it not be action at a distance? Yet Newton thought the notion of action at a distance to be an 'absurdity'. Nor can there be a mechanical ether as an intermediary; he had himself shown this in the *Principia*. No wonder that critics like Leibniz and George Berkeley objected: the new mechanics is a convenient mathematical scheme, they said, but it does not really *explain* motion. Newton struggled to find a response, but never succeeded.

His mechanics *was*, however, superbly successful in organizing motions of all sorts under a single descriptive scheme. The basic constituents of matter are to be characterized by a handful of 'primary' qualities, like extension, hardness, and mass, precisely the qualities that ensure that the basic science of matter *is* mechanics. And these qualities themselves can be understood (or so Newton thought) in terms of our ordinary experience. It is not clear where mind fits in all of this; though Newton himself found no difficulty in supposing that mind (and, indeed, many other kinds of 'spirit') can act on body, the implicit determinism of his mechanics, if taken to be universally applicable to all motion, made the status of mind progressively more problematic to Newtonians of the next generation. And his combination of empiricism and deductivism quickly proved vulnerable to the probings of David Hume. It would not be an exaggeration to say that for the next two centuries, the energies of philosophers were to be directed, in large measure, to the challenges Newton had bequeathed them.

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ERNAN MCMULLIN

Nicholas of Cusa

Nicholas of Cusa, also called Nicolaus Cusanus and Nikolaus von Kues, was one of Germany's first metaphysicians. Born in 1401 in the city of Kues, across the Moselle River from Bernkastel, he studied at the Universities of Heidelberg, Padua (Italy), and Cologne. At Padua he received his doctorate in canon law (1423). Declining a professorship offered by the University of Louvain in 1428 and again in 1435, he later was made a papal envoy to Germany (1438–48) and thereafter was named cardinal of St. Peter in Chains (1448) and bishop of Brixen (1450). His death occurred in Todi, Italy, in 1464. His valuable personal library remains intact and is located in the hospice that he founded for elderly men that is still operational in Bernkastel-Kues.

Nicholas's first philosophical work, *De docta ignorantia* (1440), is also his most important one, since it contains his major metaphysical teachings:

1. his doctrine of God,
2. his doctrine of God's relationship to the world,
3. his cosmological speculations,
4. his Christological synthesis.

1. God, as absolutely Maximum, is all that which can be. That is, he is Being itself (*esse ipsum*), the Creating and Sustaining Power – or Ground of being – of all beings (*entia*). Being itself is undifferentiated Being

and, thus, escapes comparison with all finite beings, which, necessarily, differ from one another by virtue of their different forms. In *De docta ignorantia*, as elsewhere, Nicholas asserts that there is no proportion between the finite and the Infinite, so that all predication regarding God's nature is symbolical. When he speaks of the coincidence of opposites in God, he does not mean to deny the validity of the principle of non-contradiction; rather, he is insisting upon the absolute simplicity of Divine Being. Nicholas's method of learned ignorance allows us, for purposes of worship and discourse, to conceive of God *as if* he were supreme goodness, beauty, justice, etc. Yet, a wise man will know that, necessarily, he is ignorant of God's nature – in spite of the fact that the patriarchs, the prophets, and Christ himself have disclosed fitting symbols for discoursing about him.

2. Though Divine Being infinitely transcends all finite being, it is also immanent in finite being – just as the reality of an original is present in a mirror-image of itself. That is, without the original there would not exist the given mirror-image. So, too, without God the world would not exist (even though without the world God would unchangedly continue to be). Though Nicholas states that God, as Ground of being, is all things, he nowhere maintains that all things are God. Instead, he says repeatedly that *in God* all things are God. For as antecedently present in God all things are the uncreated God himself rather than being their own finite, created selves. The universe is a contracted (i.e., a delimited) *reflection* of God's being but is not God in a contracted state. For God, who is Absolute, is never contracted, and a reflection of God's being is not God's being. Each finite thing may be called a created god in that it symbolically reflects Divine Perfection because its nature is as perfect as it can be. Natures exist only in individuals, notes Nicholas in *De docta ignorantia*, where he seems to endorse a theory of universals that can be termed moderate realism. Nicholas calls God the Form of all things and the Being of all things. But since finite beings have their own forms, God is the Form of all things only in the sense that, *qua* Creator and Sustainer, he is the Former of the respective finite form of each thing. Similarly, he is the Being of all things in that he is the Creative and Sustaining Source of every finite being. (Nicholas is sometimes incorrectly interpreted as teaching that God is each finite thing's being – i.e., as teaching that each thing in its substantial being is God – so that finite things differ from one another only accidentally.) Since all things are present in God and God is present in all things, it follows (we are told) that each thing is present in each other thing; but as present in a given particular, all other things are that particular.

3. According to Nicholas the universe is both finite and infinite, though in different respects. It is infinite in that it is unbounded by anything physically external to it; it is finite in that it has definite measurements that are known to God alone. The earth is sphere-like, and it appears to us to be at the centre of the universe – though through learned ignorance we may ascertain that the universe has no exact physical centre, even as it has no precise physical circumference. The Earth, the Sun, the Moon – indeed, all planets and stars – have a motion, a light, a heat, and an influence of their own. Though Nicholas teaches that the Earth moves, he does not indicate what kind of motion this is. To be sure, his cosmology does *not* prefigure the Copernican theory; yet, it does constitute a significant step away from the Aristotelian conception. In last analysis, Nicholas's cosmology is not scientific but rather is speculative in a theological way: God is the universe's centre and circumference, since his power and knowledge are omnipresent.

4. As the world was created by means of the eternal Word of God, so it will return to God by means of his Word, which is united to the human nature of Jesus. Jesus's human nature is said by Nicholas to be maximally perfect and, as thus perfect, to be subsumed in the divine nature (without the transformation of either nature into the other). It is a microcosm that enfolds the higher and the lower created orders and, thus, all the perfection of the universe.

Many of Nicholas's ideas made their way into the stream of early modern thinking and seem indirectly to have influenced such later

thinkers as Leibniz (though no direct influence can be demonstrated). Important parallels exist between Leibniz's views and Nicholas's notion of perfection, as well as Nicholas's doctrine that material objects are (in principle) infinitely divisible and that no two things are exactly alike. Nicholas also influenced Giordano Bruno (1548–1600), who misunderstood his conception of the infinite universe; and, in our own day, his effect on Paul Tillich (1886–1965) is patent. Nicholas's own thoughts were shaped by Anselm of Canterbury (1033/4–1109), Aquinas (1225–74), Augustine (354–430), Eriugena (*c.* 810–77), Heimericus de Campo, Meister Eckhart (*c.* 1260–1327), Proclus (410–85), Pseudo-Dionysius (6th century), and Thierry of Chartres (*c.* 1100–1156) to name only a few. Besides *De docta ignorantia* his most important metaphysical works include *De coniecturis* (1442–3), *De dato patris luminum* (1445–6), *De visione Dei* (1453), *De beryllo* (1458), *De possest* (1460), *De li non aliud* (1461), *De ludo globi* (1462–3), and *De apice theoriae* (1464).

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JASPER HOPKINS

Nicole Oresme

Nicole Oresme (*c.* 1320–82) taught first in the Arts Faculty at the University of Paris, and became grand master of the College of Navarre in 1356 and bishop of Lisieux in 1377. He was the teacher of Charles V, and the latter entrusted him with the task of translating some of Aristotle's main writings from Latin into French. Oresme's translation of *De caelo*, entitled *Le Livre du ciel et du monde*, which was finished in 1377, stands out owing to its lengthy and original commentary. Moreover, he wrote important mathematical and astronomical treatises on the incommensurability of motions as well as an essay on money. Along with John Buridan, Oresme was the most distinguished French natural philosopher of the 14th century.

Oresme's principal importance for the genesis of mathematical natural science lies not in his specific results, but in his method. His thinking is sceptical for theological reasons: in defending faith he tries to prove that natural reason is incapable of definitive truth about the nature of things. To this end he develops alternatives to Aristotelian doctrines, between none of which a reasonable decision is possible. Faith, therefore, must have the final say.

Oresme's theological–sceptical mode of argumentation had an unintentional effect on the history of science. It led to a calling into question of the ontological foundations of Aristotelian natural philosophy and thereby made way for the subsequent mathematical and experimental treatment of scientific problems. This applies especially to the Aristotelian view of natural motion. Oresme's commentaries employ thought-experiments which make every motion seem relative to the observer's standpoint. Although unaware of the impetus theory, he succeeds in formulating, within the frame of the Aristotelian doctrine of motion, the idea of a particular kind of motion which dissolves the Aristotelian dichotomy of natural and forced motion. His kinematics of circular motion yields a constant of motion which was then interpreted by Galileo as circular inertia.

Oresme's innovations in the theory of motion make possible his cosmological thought-experiments. He discusses the possibility of diurnal rotation of the earth in terms of mechanistic models. The Aristotelian graded cosmos with its hierarchical order is thereby replaced by a functional order which forms the presupposition for the notion of a homogeneous world. The principle of economy prepares the way for the modern concept of system-rationality which replaces the theological conception of nature and its underlying metaphysics of substances. As

modern as these elements are, including Oresme's discussion of a possible rotation of the earth, it is misjudged to regard him as a pioneer of the modern mathematical–scientific world-view. For his sceptical attitude prevents him from effecting a reconciliation of natural philosophy and mathematics. Oresme's concept of nature thereby proves to be ontological, removing nature from the realm of what is subject to calculation by human reason.

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FERDINAND FELLMANN

Nietzsche's Metaphysics

Two Main Metaphysical Principles. Friedrich Nietzsche (1844–1900) is best known for his fierce critique of religion and morality. His views on man and value are based on two fundamental metaphysical principles, the will to power and eternal recurrence, which occur in *The Gay Science* (1881/2). However, Nietzsche's metaphysics never progressed beyond an outline.

The will to power is a central concept for Nietzsche; with it, he hoped to explain all organic processes, biological and psychological phenomena, and cognitive and intellectual phenomena: knowledge, values, ends, meaning, and moral norms.

The theory of eternal recurrence was intended to provide an alternative to all theistic and pantheistic conceptions; "both of the most extreme modes of thought – the mechanical and the Platonic – come together in eternal recurrence". The cosmological–metaphysical hypothesis that everything that happens must reoccur without end is based in part on the assumption that the universe is a closed system of force whose quantity of force is finite and constant. Force is uncreatable and indestructible. The universe has no rigid final state; it is the sole *perpetuum mobile*, without an outside cause, "a play of forces and waves of force, eternally changing, eternally returning in monstrous years of recurrence".

Nietzsche described this "Dionysian world" as "will to power and nothing else". Thus within the universe the will to power is the universal principle. Walter Kaufmann has contended that the will to power is a projection of human passions on to the cosmos rather than a primary principle. Nietzsche saw numerous parallels between the human and the cosmic, attempting to understand material and organic processes as more primitive forms of human passions, and defending his view on the basis of its ontological economy, since it required only one form of causality. But Nietzsche does not simply biologize the inorganic sphere; this would make the will to power a mere metaphor. While the inspiration for his view is biological, for Nietzsche the organic, psychological, social, and cognitive spheres are ruled by the same quantum force dynamics as the inorganic, and are merely higher forms of organization of force-quanta.

The Will to Power. Nietzsche speaks of will to power in both the singular and the plural. In the singular it designates the sole quality that exists. The world as a system of forces exhibits this quality, but only in the form of quanta of power or force. Reality consists of an interplay of such quanta; there is no will as such, only centres of will whose power is continuously augmented or diminished. Nothing but force exists; the physicists' force must be ascribed an inner will, the will to power; all forces are of the same kind as that of the will, imposing on and changing other subjects.

Nietzsche sees quantity as a sign of quality; a purely quantitative world would be immobile and dead. The dynamic power must possess an inner quality, which lies in the "tendency, the longing to be greater", to increase in quantity. So movement and change can only exist because of this irreducible quality, the will to power is a

necessary condition of all change and thus of eternal recurrence.

All centres of force strive to increase their power (not, as Spinoza thought, merely to preserve themselves), and this striving is the sole reality. The primal will is to become stronger, impose oneself on others, strengthen, possess, attain mastery. For Nietzsche, 'will' is not the will to life of Arthur Schopenhauer, or desire, instinct, or drive, but solely this will to augmentation and expression of power. The will to power is uncreated, has not come into being from something else, and cannot be explained in terms of development. It is the ultimate fact.

Nietzsche calls the force quanta "wills to power" because each one radiates power on all others and attempts to extend its influence over the whole of space; it both exercises its own power and resists that of other centres, so that there is a dynamic tension amongst them. There is no adiaphoria or neutrality among quanta, only a continual trial of force amongst them, the weaker trying to defend themselves against the predations of the stronger.

The two forces known in Nietzsche's time to act over a distance were gravitation and electromagnetism. Both obey inverse square laws, though while electromagnetic force can either attract or repel, gravity only attracts. Nietzsche was strongly influenced by the *Philosophiae naturalis theoriae* (1759) of Roger Joseph Boscovich (1711–87). Boscovich united both attraction and repulsion in a single force, which attracted at large distances but repelled at short distances, and attempted thus to explain cohesion, elasticity, and chemical affinity. Boscovich assumed the existence of "prime material elements", indivisible centres of mass or force, which possess inertia and act on each other. They move according to Newton's laws, are finite in number and finitely far apart from each other, so the world as a whole is finite. This assumption is crucial for Nietzsche's theory of eternal recurrence.

Following Boscovich, Nietzsche rejected the materialist's atoms – tiny lumps of inert matter – in favour of force, one form of which is gravity. Nietzsche uses 'atom' sometimes for these rejected material things, sometimes for atoms of force. Material atoms are mere fictions facilitating calculation. Things as substrata of predication are also fictions: the continuous nature of all interactions makes it inadmissible to speak of individuals or of the same things. Identical things are creatures of thought, itself a form of will to power. If the linguistic contributions of number, thing, and subject are left out, one is reduced to dynamic quanta alone. The concepts presupposed in classical mechanics – matter, atoms, weight, pressure, collision – are interpretations made in the language of the senses, not objective facts. Mechanism and materialism are false.

Mechanical laws are likewise fictions: events do not follow rules. For Nietzsche, the sequence of events in itself knows neither cause nor effect, only a lawless struggle for power amongst the quanta of force. The only causality is the conflict between wills. The will to power is the sole basis of all change, which consists in the extension of power of one centre over another. Though power is constant in total, unceasing change and hence temporality is part of its nature. The reason for this, and for all imperfection, lies in the form of space: in an infinite or spherical space the world would have attained static equilibrium. Since this has not happened, Nietzsche concludes it is not possible, assuming that there was no beginning and no creation *ex nihilo*.

Living systems exhibit will to power in a special way, in that they accumulate power. Life is a plurality of forces connected by a common process of nutrition, resistance to and assimilation of outside forces, forming, transforming, and ingesting. All living things attempt to extend their power and dominate the weaker.

Organs are means of interpretation in the service of domination; they delimit and assess differences of power. Drives are forms of the will to power. Man possesses diverse and conflicting drives, which strengthen when coordinated but weaken otherwise, but their synthesis has made him master of the earth. Pleasure and pain are mere side-effects of the increase or decrease of power; pleasure is not an end in itself.

The will to power explains, according to

Nietzsche, why Darwinian selection does not always favour the strongest individuals and groups: the strong are too weak to overcome the organized instincts of the herd of weaklings who make up the majority.

Cognition is seen as a form of assimilation, grasping new phenomena by use of the old and familiar. Nietzsche's conception of assimilation thus resembles that of Jean Piaget. The complementary concept of accommodation is less explicit in Nietzsche. The tendency to take things as alike is modified by success and failure; there is a tendency to fit in with things so as not to endanger life. Organs of cognition develop not out of a need to avoid deception but because of their utility in ensuring preservation and growth. Our cognitive apparatus abstracts and simplifies the world, not to gain knowledge but as an instrument of power. Cognition reads meaning into reality which is foreign to it, since reality is process or becoming, whereas cognition looks for static being. Cognition thus falsifies, but it is necessary for life. The will to truth is will to power, reinterpreting the evanescent as enduring.

This raises problems. How can cognition recognize itself as will to power? Is this self-cognition of cognition itself not true cognition? Does the view that cognition fictionalizes not start an infinite regress when applied to itself?

The basic principles of logic are for Nietzsche regulative articles of belief, not empirical knowledge. They rest on presuppositions corresponding to nothing in the world; they are posits helping to form a world which is to count as true for us. Our belief in logic presupposes our belief in enduring things, which assumes that there are like cases. The will to render things alike is will to power. Logic is useful for living, but discloses no truth about reality. Nietzsche, however, seems not to deny internal logical truth, coherence, and consistency. His view of knowledge and logic has constructivistic aspects. If knowledge and logic are to be of use, the apparatus of cognition must conceive the force environment in such a way that its bearer is likely to survive. Too many fictions will be dysfunctional. Creatures that continually produce false assumptions about their force environment have the tragic but praiseworthy tendency to expire before they reproduce. The will to power is forced to become will to truth.

Morality is also a form of will to power. Its original function was to avoid demise due to conflicting drives. It is in general a system of valuations concerning a being's conditions of life, and criticism of morality is the sublimest form of morality. Seen genetically, however, morality is a special case of unmorality. The will to power expresses itself in the history of morality, mainly in two types: the morality of capability, *virtus*, action (Caesar, Napoleon, and Goethe's Faust are examples); and the morality of reaction, passivity, and slavery, a morality which aims to dominate the stronger, but merely preserves without creativity. This is the morality of Christians, socialists, parliaments, the herd.

Eternal Recurrence. Nietzsche consciously opposed his postulate of eternal recurrence, which he saw as a scientific hypothesis, to established religion and metaphysics. He found inspiration for his views in ancient writers: Plato's *Phaedo*, Empedocles, the Stoics, and Pythagoreans; but also among modern authors like Heine and Schopenhauer, as well as in scientific literature: Boscovich, and Nietzsche's contemporaries Johann Zöllner, Johann Vogt, and Julius Mayer.

We may reconstruct Nietzsche's argument for eternal recurrence. This has two parts: the first part attempts merely to show eternal recurrence is possible.

1. The world consists of centres of force with the spatial form of indivisible mathematical points. This assumption does not, *contra*, for example, A. C. Danto (1965), entail the infinite divisibility of power.
2. There are only finitely many centres of power. The concept of infinite power is rejected as absurd. The world contains a determinate amount of force and a determinate number of centres of force (*contra* Spinoza and Giordano Bruno).
3. The overall amount of force and its properties are constant. Matter does not 'learn'; it does not acquire new properties.

4. Force, and centres of force, are uncreated. Nietzsche rejects creation *ex nihilo* by a creator God. The world had no beginning.
5. Nietzsche accepts the principle of conservation of energy. The amount of force neither increases nor decreases.
6. It follows that the number of possible combinations of positions and quantum values of the finitely many centres of force (the 'state space', as it would now be called) is finite and fixed.
7. The centres of force, however, have existed for an infinite time.
8. There is no diffusion in an infinite space and a stable equilibrium is not attained. Nietzsche expressly rejects infinite space.
9. Because of the finitude of space and the conservation law, force cannot be dissipated. So
10. every state of the world must be realizable infinitely often. (Compare Schopenhauer: "An infinite time has passed up to the present moment, wherefore everything that could have come into being has come into being".)

So far only the possibility of external recurrence has been shown. The second part of the argument, building on the first, attempts to show that external recurrence actually occurs.

11. An attempt to strengthen 8. There is no diffusion. Nothing comes into being. The fact of mind and thought show that the world has not reached a state of stable equilibrium. This is for Nietzsche the sole certainty among a welter of world hypotheses.
12. If space were spherical, then in an infinite time a stable equilibrium would have long since been attained.
13. There is no possible stable final state of the world.
14. Space must have a determinate, but non-spherical shape (from 11., 12.). The shape of space must be the cause of movement. Otherwise, however, we know nothing about space.
15. Infinite novelty is excluded: under the assumptions 1. to 4. such a thing would be a miracle, "a mad religious wish, the longing of Spinoza". Artificial maintenance of things by a creator God is ruled out, so there can be no increase or decrease in the number of combinations through such external influence. Hence
16. everything that can take place must do so infinitely often (*The Will to Power*, §1059).

Since there are only finitely many combinations, and force can never rest, never become 'unforce' (*Unkraft*), the past must be actually infinite and cyclical. If the actual period force combinations are *a b . . . z*, and world history looks like . . . *a b . . . z a b . . . z a b* (suppose now we are in state *b*), we can consider the 'forwards' direction *a b . . . z*, yielding an infinite progression up to the present, or the 'backwards' direction *z . . . b a*, yielding an infinite regress into the past. If we consider these two directions as opposite ways around a circle, we get the idea that "Time itself is a circle", as Nietzsche writes in *Zarathustra*. "The middle is everywhere. The path of eternity is bent." In this way, Kant's first antinomy might be solved. The past is infinite in extent but finite in variety: that which is to come has already been.

As the mathematician Oskar Becker pointed out in 1936, Nietzsche's theory is worthy of respect. It is the more so now, as it stands a chance of being falsified in the next few years. If the gravitational pull of the 'dark matter' of the universe, possibly consisting mainly of neutrinos, turns out to be insufficient to halt cosmic expansion, the universe would expand and diffuse for ever. Condition 8. would thus be violated, and the proposition that the past is infinite would also be untenable. If, on the other hand, there is enough matter in the universe to halt and reverse its present expansion, the universe could be broadly cyclical. This would not of itself support Nietzsche, since he also assumed indivisible centres of force with finitely many properties. Nevertheless, an honest refutation would show the theory to have been, as Nietzsche said it was, an interesting *scientific* hypothesis.

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STEPHAN LANDOLT AND PETER M. SIMONS

Nominalism

The term 'nominalism' derives from '*nomen*' via '*nominales*', the latter term first appearing in the 12th century. Both the meaning and extension of the term are subjects of controversy. As used in 20th-century philosophy, it has several connected meanings.

1. In the first and traditional sense, nominalism is the doctrine that everything that really exists is particular, that there are no real (mind-independent) universals. Its opposite is realism with respect to universals, whether of a strong (Platonistic, *ante rem*) or a moderate (Thomistic, *in re*) sort. Nominalism in this sense subsumes conceptualism, the doctrine that universals exist not independently but as concepts in the mind, the most common form of nominalism in antiquity and the Middle Ages. Such a conceptualism is ascribed to various Stoics, by some to Aristotle, to Peter Abelard, William Ockham, Leibniz, and John Locke. The name 'nominalism' is not wholly inappropriate to it because it was commonly held, e.g. by Ockham, that concepts are mental names.
2. Nominalism in a more restricted sense agrees with conceptualism that universals exist only in dependence on minds, but takes them to be words properly so called (*vox*), as distinct from concepts (*conceptus*). Sometimes called extreme nominalism, this view is ascribed by Abelard to his teacher Roscelin of Compiègne (*c.* 1045–*c.* 1120) and can be found in Thomas Hobbes.
3. A still more radical position is to deny that universals exist at all, whether as real entities, concepts, or words. This view often shades into nominalism (1) if care is not taken to distinguish existence from mind-independent existence. George Berkeley would appear to have held this view.

Any denial of real existence to some items offers these three (not exhaustive) possibilities: outright denial, acceptance as mind-dependent, and acceptance as words. Historically the positions developed in connection with universals, but the pattern can be repeated.

A more modern meaning of 'nominalism' extends the denial of universals to all abstract entities, including in particular mathematical objects. This is the sense employed by W. V. O. Quine and Nelson Goodman in their essay "Steps toward a constructive nominalism" (*Journal of Symbolic Logic*, 1947) which begins with the trenchant statement "We do not believe in abstract entities". If not all putative abstract entities are taken to be universals, then this is a stronger doctrine than nominalism (1). In the ontological controversies about mathematical objects the positions opposed to this form of nominalism are often termed (*pars pro toto*) 'Platonism'. Species of strong nominalism with respect to mathematical objects include mentalist constructivism (nominalist (1), e.g. L. E. J. Brouwer), formalism (nominalist (2), e.g. the mathematical collective Nicolas Bourbaki), and fictionalism (nominalist (3), e.g. Hartry Field).

Some species of nominalism accept entities which have also misleadingly been called 'abstract', namely individual accidents, moments, or tropes. These are dependent on their bearers, but not necessarily on minds. To deny them as well and insist that only independent things or substances exist is to embrace the stronger view of reism (Franz Brentano, Tadeusz Kotarbiński).

A somewhat deviant sense of 'nominalism' is due to the later Goodman, for whom it consists in the refusal to recognize classes. As

Goodman's own case shows, this is compatible with acceptance of real universals (*qualia*). For those (such as the later Quine) for whom all *abstracta* are classes, nominalism of this sort comes to the same as the strong nominalism of the 1947 joint paper.

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Nothing

Since ancient times philosophers have wondered about the meaning of such negative pronouns and adverbs as 'nothing', 'nobody', 'never'. Apparently, they are nothing else but devices for encapsulating a negation plus an indefinite particle or a term like 'something', 'somebody', 'ever'. But what about negation itself? What is meant by 'not'? Even though 'nothing' is short for 'not . . .anything', the problem remains of finding out what it is that thereby modifies the existential quantifier 'anything' or the entire proposition it introduces. Now, the meaning of negation in general being hard to elucidate, the difficulty becomes all the more serious precisely when negation attaches itself not to this or that property in particular – with the resulting phrase standing for the given property's complement, the 'not' being thus taken to be simply syncategorematic – but to anything in general, or to existence. For, granted that there are properties such as not-being-a-dog, what can be meant by 'not being anything' or 'failing to exist'? Furthermore, the fact is that the negative pronouns and adverbs can be nominalized. Certain of those nominalizations can be paraphrased through quasi-synonyms such as 'not-being' or 'inexistence'.

Parmenides warned that only being could be thought about, while non-being was both unthinkable and unsayable. Plato in the *Sophist* showed that any such contention contradicts itself: in fact non-being also exists, but rather than being something thoroughly or wholly opposed to being, it is just other-than-being: it negates being in a non-absolute way. Augustine tried to explain both creation and human fall by resorting to some reification of nothingness, while at the same time wanting to believe that by so doing he had disposed of any ontological commitment to any negative principle, the principle being *nothing*.

After other medieval thinkers debating the ontological status of nothingness, in the 13th century the Cathar philosopher Bartholomeus de Carcassonna (born *c.* 1190) brought up the problem anew by claiming that Evil is the origin of Nothingness which in turn is the stuff of deprivation and imperfection in the world. Bartholomeus's critics alleged that '*nihil*' cannot be construed in such a way, since e.g. when Jesus is fasting he is not thereby eating Nothingness. Yet, Bartholomeus had not contended that every occurrence of '*nihil*' was to be construed as standing for Nothingness. (On such a controversy see Nelli 1978.)

The most outstanding continuator of that Platonistic tradition in the Renaissance was Nicholas of Cusa, whose philosophy hinges upon asserting the coincidence of opposites in God. In his early *De docta ignorantia* (1440) Nicholas regards God as both maximum and minimum and yet beyond such determinations, in such a way that he is closer to nothingness than to being something (*magis accedere ad nihil quam ad aliquid*). Here there is no possible paraphrasing away '*nihil*' as '*non . . . quiddam*', i.e. 'not . . . anything'. Being something is being something definite, which is ruled out by God's infiniteness. Nicholas's last writings (e.g. *De li non aliud* and *De uenatione sapientiae*, both of 1462) somewhat reshape the coincidence of opposites, by emphasizing that as they are in God opposites are free from mutual opposition. Nicholas now stresses the reality of nothingness (at that stage usually denoted by the expression '*ipsum nihil*', which openly defies the attempts to eliminate '*nihil*' through paraphrase) but in a way places it below God: God in itself is now conceived primarily as

Not-Other or *Possest* (that for which to be able to be is to be) whereas Nothingness is viewed as the root of passive possibility (*posse fieri*). Nothingness seems to be instead God-as-towards-creatable-things, so much so that even those things' mere possibility is created from God's own nothingness.

There is also a different traditional line concerning usage of the words 'nothing' and 'non-being', the one stemming from some remarks by Aristotle (*Cat.*, 13b15–19) according to which if and only if a term is denotationless, all affirmative sentences it enters into are false; whence the principle follows, that a non-being is (or, better, would be) what lacks (or would lack) any and every property. That principle – which in the Aristotelian corpus exists alongside a different assessment of such sentences (see a detailed discussion in Peña 1985 – was bequeathed to scholastic masters. Thus the Spanish Jesuit thinker Francisco Suárez in his *Disputationes Metaphysicae* maintains the principle in several ways; his *Disputatio* 54, devoted to the *ens rationis*, claims (s.5, no.16): 'Aristotle says that this sentence is true, *non ens esse non ens seu nihil*, since, if it is a non-being, it is not a man or a horse or an anything like that.'

The principle was then handed down to 17th-century philosophers. Spinoza received it eagerly and argued on its basis for some of his own boldest claims. Thus prop. I 9 of his *Ethics* (the more reality or being a thing has, the more attributes it possesses) is a generalized version of the principle. Within the Spinozistic system that proposition spells trouble, since, by prop. II 7, the order and the connection among things are the same as those among ideas; hence, prop. II 33 will conclude that there is nothing positive in any idea making it false: falseness is just lack of knowledge (prop. II 35) and all the Aristotelian tradition has always regarded lacks as non-existent (see again Suárez's *Disputatio* 54, s.5). Spinoza's way out fell back on reduplicative clauses – *as* it is in God, any idea is true, but not always as it is in us (see prop. II 36, prop. IV 1).

Leibniz, too, inherited the above-mentioned Aristotelian principle. In his *General Investigations* (Leibniz 1982) he says: 'Not-being is what is merely privative, that is to say what lacks everything, i.e. not-Y, which means not-A, not-B, not-C, etc. That is what people mean by saying *nihili nullas esse proprietates*.' (On the general significance of those remarks, see Burkhardt 1980.) However Leibniz is also led by his logical reflections to a quite different approach, namely that whenever a term, '*A*', denotes no possible being, '*A est B*' is true. Since Leibniz is confident that no possible thing is *B* and not-*B*, the sentence '*Nihil est B non-B*' will then be true, both taken in the sense of 'There is no thing being at the same time *B* and not *B*' and in the sense of '[What is] nothing is [what would be] both *B* and not-*B*', i.e. a non-being would be what would have mutually contradictory properties. (See Couturat, *La logique de Leibniz*, 1901, and Peña 1990.) The latter approach is bound to clash with Leibniz's cleaving to the syllogistic law of subalternation (according to which, if it is generally true that *A est B*, then there is some entity both *A* and *B*: see op. cit., §154). In any case, Leibniz, as well as almost all 17th-century thinkers, held on to the Aristotelian tradition which rejects any reality whatsoever liable ever to be denoted by 'nothing'. 'Nothing' is just 'Not . . . anything' in whatever context.

The opposite line (the one rooted in the Platonistic tradition) is taken by Hegel, who, at the beginning of his *Logic* developed the dialectics of Being and Nothingness, by arguing that Being as such contains neither being-this nor being-that, and so it equates Nothing, a purely negative concept. More recently Martin Heidegger in several essays has contended that Nothingness is given to us through anguish, thus evincing a reality of sorts which cannot be understood within the framework of logical thinking. Rudolf Carnap has criticized such a stand, pointing out that it stems from a purely syntactic mistake, namely failing to realize that 'nothing' is no noun phrase proper. But even if some of Heidegger's remarks can be easily disposed of by explaining away troubling occurrences of 'nothing' in natural language, that does not show that there is no problem at all. What is it that allows us to nominalize 'nothing' in apparently reasonable arguments

(e.g. this one: 'Should there be nothing, even then there would be something, namely that lack of anything, that very same Nothing, or nothingness – the state of affairs consisting in there being nothing')? Some people have also argued that the meaning of negation is not adequately accounted for by taking it to be a purely syncategorematic symbol. But then what is that entity, the *not*? Finally, within analytic philosophy itself some accounts are explicitly or implicitly committed to posit an entity which is Nothing(ness). Thus Gottlob Frege's semantics entails that within a formula such as 'Nothing is a unicorn', the segment 'Nothing is' means a second-order concept (property), namely that of being a first-order empty property. But such a second-order property exists. One of the criticisms such an account of Nothing(ness) has prompted is that it jettisons Parmenides's saying that Nothingness is not.

Can such conflicting considerations be all of them duly taken into account or even somehow or other merged into a unified treatment? If that is possible at all, the approach which would alone be able to perform the task would most probably be a dialectical metaphysics according to which the particle 'not' stands for an entity which both (up to a point) exists and yet (to some extent) fails to exist; in so far as it is a negative principle – a root of deprivation, of lacking, of failing to be – it is non-existent, but its non-existence is not absolute. Attempts have been made to make such a neo-Neoplatonistic approach viable via a paraconsistent logic. But some critics have maintained that there is no need for any such solution, Carnap or Frege having already finally elucidated the issue.

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Number

The most fundamental ontological problem to which our various numerical and arithmetical practices give rise is this: (Q) Do there exist such entities as numbers and, if so, what sort of entities are they? Broadly speaking, any acceptable answer to (Q) will have to conform to two sets of constraints – arithmetical and epistemological. On the one hand, that is, the existence of, and warrant for, our normal uses of number concepts (in counting, in empirical ascriptions of number, and in arithmetic and analysis) should remain by and large unaltered by the answers we give to (Q). And on the other hand, the answers we give should not render number concepts or the truths of arithmetic unintelligible, inexpressible, or unknowable. The history of the subject has been determined largely by the tension in which these two requirements stand to one another.

Platonism, or platonic realism, is the theory that numbers are ontologically autonomous abstract objects. As abstract, they are both non-spatio-temporal and causally inert; and as autonomous, they exist, and have whatever properties they have, independently of any facts concerning our beliefs, concepts, perceptions, or practices. According to Gottlob Frege, for example, a mathematician no more creates, or constructs, or determines the objects he studies than an astronomer creates or constructs or determines the stars or planets. In both cases scientific objectivity consists in the discovery of the truth about independently existing things. And here the notion of truth itself must be epistemically unconstrained, investigation independent, or verification transcendent. The most widespread version of Platonism identifies numbers with 'logical

objects' such as classes or sets. (See Bernays (1964), Frege (1884, 1893–1903), and Gödel (1944).)

Psychologism identifies numbers with mental entities – with ideas, impressions, concepts, presentations, and the like. Although widespread in the 19th century, psychologism never recovered from the devastating criticism it received from Frege (1884), who argued that it failed to account for the objectivity, the universal applicability, and the necessity of arithmetical truth.

According to *materialism*, numbers are properties of 'external things'. J. S. Mill (1843) argued that numbers are empirical properties of aggregates of physical things, and that the truths of arithmetic express inductive generalizations about the behaviour of such aggregates. This theory was also criticized by Frege (1884), on the grounds that it failed to account for our knowledge of large numbers, or for the universality and necessity of arithmetical truths. In recent years, empiricism has nevertheless undergone something of a revival. (See e.g. Bigelow (1988), Kitcher (1984).)

According to the most naïve version of *formalism*, numbers are to be identified with numerals, that is, with actual, perceptible signs or marks; and the truths of number theory are to be construed as truths about such signs. This suggestion is implausible and would cripple arithmetic. A more sophisticated version of formalism (unlike all the theories mentioned thus far) answers (Q) in the negative: there are no such things as numbers, and there is nothing *of which* the so-called propositions of arithmetic are true. Indeed, on this theory, arithmetic does not consist of propositions or assertions but, rather, of rules for the manipulation of signs.

Finally, a rather heterogeneous group of philosophers and mathematicians have answered (Q) in terms that are broadly *conceptualist*. The group includes, e.g., Kant, Edmund Husserl, Leopold Kronecker (1823–91), L. E. J. Brouwer (1881–1966), and Ludwig Wittgenstein. Despite the profound differences between them, they agree in rejecting Platonism's commitment to the ontological autonomy of numbers, claiming instead that numbers are the products of human construction, and hence that in mathematical contexts 'to exist' should be construed as 'to be constructed', or, in many cases, as 'to be constructible'.

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DAVID A. BELL

O

Ockham. See: William Ockham

Ontological Arguments I: Classical

The ontological argument has fascinated philosophers ever since it was loosed on an unsuspecting world by Anselm of Canterbury in the 11th century.

And so Lord, do thou, who dost give understanding to faith, give me, so far as thou knowest it to be profitable, to understand that thou art as we believe and that thou art that which we believe. And indeed, we believe that thou art a being than which nothing greater can be conceived. Or is there no such nature, since the fool has said in his heart, there is no God? But at any rate this very fool, when he hears of this being of which I speak – a being than which nothing greater can be conceived – understands what he hears, and what he understands is in his understanding; although he does not understand it to exist.

For it is one thing for any object to be in the understanding and another to understand that the object exists. When a painter first conceives of what he will afterwards perform he has it in his understanding, but he does not yet understand it to be, because he has not yet performed it. But after he has made the painting, he both has it in his understanding, and he understands that it exists, because he has made it.

Hence even the fool is convinced that something exists in the understanding, at least, than which nothing greater can be conceived. For when he hears of this he understands it. And whatever is understood exists in the understanding. And assuredly that than which nothing greater can be conceived, cannot exist in the understanding alone. For suppose it exists in the understanding alone; then it can be conceived to exist in reality; which is greater.

Therefore, if that, than which nothing greater can be conceived, exists in the understanding alone, the very being, than which nothing greater can be conceived, is one, than which a greater can be conceived. But obviously this is impossible. Hence, there is no doubt that there exists a being, than which nothing greater can be conceived, and it exists both in the understanding and in reality (*Proslogion*).

This argument has excited enormous controversy. Nearly every great philosopher from Anselm's time to ours has had his say about it: Aquinas rejected it; John Duns Scotus 'coloured' (modified) it a bit and accepted it; René Descartes and Nicolas Malebranche accepted it; Leibniz accepted a version of it; Kant rejected it (and delivered what many have thought the final quietus to it); Arthur Schopenhauer thought it at best a charming joke; and many contemporary philosophers seem to think it is a *joke* all right, but not at all a *charming* joke.

The first critical response to Anselm's argument came from a contemporary and fellow monk, Gaunilo (11th century), who wrote a reply entitled "On behalf of the fool". Perhaps the most interesting of his objections was his claim that with this sort of argument one can prove the existence of anything you please: a greatest island, for example.

Anselm replied first of all that what is at issue is not a *greatest* being (or a greatest island), but a being than which none greater can be conceived, i.e., a being *than which it is not possible that there be a greater*. So strictly speaking Gaunilo's conclusion should be only that there is a greatest island, a conclusion that is not particularly startling. More important, while there can certainly be a greatest island, it is not at all clear that there could be such a thing as an island than which it is not possible that there be a greater. Great-making properties for beings *as such*, says Anselm, would include, for example, knowledge, power, and goodness. For each of these there is what we might call an *intrinsic maximum*: a degree of the property in question such that it is not possible to have a greater degree of the property than that. Thus for knowledge the intrinsic maximum is omniscience; for power, omnipotence; for goodness, the property of being perfectly good. But things stand quite differently for islands: the properties that make for greatness for islands – size, number of palm trees, size of coconuts, and the like – do not have an intrinsic maximum. No matter how large an island is, there can always be a larger; no matter how many palms it has, there can always be one with more (and larger) palms. The idea of a greatest possible island, therefore, is like that of a largest natural number: a property that cannot possibly be exemplified. But then Gaunilo's objection to Anselm's argument fails.

Perhaps the most celebrated objection to ontological arguments is Kant's famous claim that existence is not a real predicate or property. Kant makes rather heavy weather over his hundred real thalers and hundred imaginary thalers, but concludes by saying:

'Being' is obviously not a real predicate: that is, it is not a concept of something which could be added to the concept of a thing . . . by whatever and however many predicates we may think a thing – even if we completely determine it – we do not make the least addition to the thing when we further declare that this thing *is*. Otherwise it

would not be exactly the same thing that exists, but something more than we had thought in the concept: and we could not, therefore, say that the object of my concept exists. If we think in a thing every feature of reality except one, the missing reality is not added by my saying that this defective thing exists (*Critique of Pure Reason*, A 600, B 628).

Kant's puzzling but suggestive remarks are directed towards Descartes's version of the argument, not Anselm's; but they have seemed to many to constitute the final and conclusive refutation of Anselm's argument. (Kant himself claimed to have shown the fatal flaw in every form of the ontological argument; Book II, Chapter III, Section 4 of the Transcendental Dialectic is entitled "The impossibility of an ontological proof of the existence of God".) But what, precisely, *is* it for a predicate to fail to be a real predicate? And suppose 'being' is not a real predicate: how, precisely, does that bear on Anselm's argument? Perhaps the answer is as follows. Suppose we use the term 'actualism' to denote the view that

1. there neither are nor could have been things that do not exist, and
2. no object could have had a property without existing.

The actualist denies that in addition to all the things that exist – houses, horses, human beings (and their like) – there are others that do not: golden mountains, perhaps, or round squares, or Pegasus, or Fafnir. If actualism is true, then (contra Alexius Meinong, Terence Parsons, and H. N. Castañeda) the things that exist are all the things there are. But then every concept or property includes existence (in the way in which a property P includes P^* if it is not possible that there be a thing that exemplifies P but not P^*); for if actualism is true, no concept is or could have been exemplified by a thing that does not exist. Now perhaps Kant's remarks on the ontological argument are best seen as an early endorsement of actualism. Perhaps what he is claiming, when he says that existence is not a real property or predicate, is just that existence is included (in the above sense) in every property or predicate, so that it can only be redundantly added to a concept; and perhaps, as he thinks of it, a *real* property or predicate is any property or predicate that (unlike existence) is not included in every property.

But how does this bear on Anselm's argument? As follows: Anselm's argument is plausibly thought to presuppose the denial of actualism. The logical structure of the argument is not entirely clear, but it is most plausibly thought of as a *reductio*: suppose the being than which it is not possible that there be a greater does not exist: then that very being, says Anselm, would be one such that it is possible that there be a greater than it ("... if, that than which nothing greater can be conceived, exists in the understanding alone, the very being, than which nothing greater can be conceived, is one than which a greater can be conceived"). So the idea is this: suppose the being than which none greater can be conceived does not exist; then *it* (that very being) would be a being than which a greater could be conceived. That is, then it would be a being that does not exist, but would none the less have the property *being a being such that it is conceivable that there be a greater being*. But of course this runs afoul of actualism: if there is no being than which none greater can be conceived, then there is no property (not even the property of being such that a greater can be conceived) had by the being than which none greater can be conceived; for there is no such being.

So if we see Kant's obscure but stimulating *obiter dicta* as an endorsement of actualism, then we can see how his comments bear on Anselm's style of ontological argument: Anselm's version seems to presuppose that some properties can be exemplified by things that do not exist, and hence runs afoul of actualism. (Of course Anselm might retort that the problem here is with actualism rather than Anselm.) Still, this does not serve to write '*finis*' to the ontological argument; it comes in many versions, and while some of these arguably presuppose the denial of actualism, others do not. Thus Charles Hartshorne (b. 1897) and Norman Malcolm claimed to detect two quite different versions of the argument in Anselm's work; and the second version can easily be restated in such a

way that it is consistent with actualism and thus sidesteps Kant's criticism. Say that a being has *maximal excellence* in a given possible world W if and only if it is omnipotent, omniscient, and wholly good in W; say that a being has *maximal greatness* if it has maximal excellence in every possible world. Then the premiss of the argument (thus restated) is simply:

Maximal greatness is possibly exemplified.

That is, it is possible that there be a being that has maximal greatness. But (given the widely accepted view that if a proposition is possibly true in the broadly logical sense, then it is necessary that it is possibly true), it follows by ordinary modal logic that maximal greatness is not just possibly exemplified, but exemplified in fact. For maximal greatness is exemplified if and only if there is a being B such that the proposition

B is omnipotent and omniscient and wholly good

is necessary; if maximal greatness is possibly exemplified, then a proposition of that sort is possibly necessary; by the above principle, whatever is possibly necessary is necessary, in which case that proposition is necessary; but then, of course, it is true.

So stated, the ontological argument breaches no laws of logic, commits no confusions, and is entirely immune to Kant's criticism. Of course it does not follow that it is wholly free from difficulty; and the central question is whether its premiss, that maximal greatness is possibly exemplified, is indeed true. This question becomes particularly poignant when we consider the property of near-maximality, a property a being has if and only if it is the only omniscient being, but does not exist in every possible world. (So a being has near-maximality if and only if it is a contingent being and is the only omniscient being.) Near-maximality may look to you every bit as possible as maximal greatness. A little reflection reveals, however, that maximal greatness and near-maximality are not compossible; they cannot both be possibly exemplified; if one is possible, the other is not. So which (if either) *is* possible? Neither answer can be proved to the satisfaction of those who accept the other; each answer, however, is rationally acceptable. So perhaps the proper verdict is this: while the ontological argument does not establish the truth of theism, it does establish or at any rate support the rational acceptability of theism.

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Ontological Arguments II: Cartesian and Leibnizian

Philosophers have usually conceived God as a supreme being, i.e., as a very special sort of object. The philosophical theory of God forms therefore a part of ontology. This theory can be developed either for the sake of rational explanation and grounding of theistic beliefs – as by Anselm of Canterbury in his *Proslogion*; or for the sake of philosophy itself – as by René Descartes, Spinoza, and Leibniz. The philosophical theory of God has thereby two variants: Anselmian – traditional and applicative, and Cartesian – general and non-theological.

Ontological Arguments. The most challenging philosophical question concerning God is the question of his existence, which is neither obvious nor immediate. By the nature of the object under consideration purely ontological arguments are most natural and welcome.

The ontological arguments for the existence of God purport to prove existence from the concept of God itself. If, like Anselm, we take God to be the most perfect being, then we will be involved in investigations of the realm of all beings as an order having some sort of maximal nodes. The Anselmian argument is a prototype of maximal principles, like Kuratowski-Zorn's or Hausdorff's lemmas (cf. Moore 1982), so

important in contemporary mathematics. Such principles are well known to be logically non-effective, and are thus rather suspect. On the other hand, we can, following Descartes, try to explain the notion of the *most perfect being* by redefining God as the subject of all perfections.

Where Anselmian-type arguments confront us with the problem of maximality in a given order, Cartesian-type arguments reduce our question to problems concerning perfections. In what follows I am going to discuss Descartes's original argument and also three Cartesian arguments suggested by Leibniz.

Perfections. The idea of perfection can be explored either for objects in general or for qualities, i.e. items characterizing their subjects. I limit myself to the second option, for we are interested in the subject of all perfections.

Perfection is a highest degree of a given limitable quality. Items incapable of a highest degree, as, for example, the size of a figure or the nature of number, do not generate perfections. Usually knowledge, power, and goodness are considered to have limits, hence the standard examples of perfections are:

omnipotence – as the highest degree of power,
omniscience – as the highest degree of knowledge,
omnibenevolence – as the highest degree of goodness.

The usual specification of the concept of God now follows: God is an omnipotent, omniscient, and omnibenevolent being.

Existence is also considered to be a perfection, obtained by maximalizing an object's reality or essence.

The above definition of a perfection is very preliminary. Either we should explain it clearly enough to work with it, or we should replace it by a more workable idea. The first two Leibnizian arguments given below (respectively by Leibniz and Kurt Gödel) follow the second option, whereas the last argument (given by J. Perzanowski) follows the first.

Descartes's Argument. The argument given by Descartes in his Fifth Meditation can be summarized as follows: God, by definition and according to our clear and distinct idea, is the most perfect being, hence the subject of all perfections. Existence is a perfection. Therefore God exists (cf. Anscombe 1987).

The argument as stated above is certainly enthymematic. To make it conclusive we must prove two claims: that existence is a perfection, and – as was observed by Leibniz – that a most perfect being is possible, i.e., that its notion is consistent, or that all perfections are compossible. According to Leibniz, Descartes proved only that God exists on the assumption that he is possible. The Leibnizian arguments outlined below are designed to establish this possibility.

On the other hand, Kant criticized the second assumption of the argument, claiming that existence is not a real predicate (cf. Kant's *One Possible Basis for a Demonstration of the Existence of God* (1763)). Observe that even if Kant is correct, this does not mean that existence is not a perfection. It is not clear that perfections are predicates. In any case the claim that existence is a perfection should also be carefully examined.

Leibniz's Argument. The argument of Leibniz (cf. *Philosophical Papers and Letters*, ed. Loemker, 1969, pp. 167f.) proceeds as follows:

1. A perfection is defined as every simple quality which is positive and absolute. This may be formalized by:
   $PF(p) =_{Df} S(p)\&P(p)\&A(p)$.

A satisfactory explanation of this definition needs an explication of the three notions involved. Gödel, in fact, provided us with a theory of positiveness, but no commonly accepted theory of simplicity and absoluteness is as yet available. Notice the order-character of the latter two notions: to be simple and to be absolute means to be minimal or maximal with respect to one or more order-relations or analyses.

Leibniz's own reasoning relies upon logical analysis, identifying simples with the simple concepts of his combinatorial logic and employing a theory of definition admitting only definitions obtained by specification or com-

plementation. It has rather a metalogical than an ontological character, as is seen particularly in steps 2 and 3 of the proof:

2. A quality of this sort is unanalysable or indefinable – for otherwise, by the Leibnizian theory of analysis and definition, it is either not simple or not positive.
3. All perfections are compatible with each other.

To see this, take any non-empty family of perfections X. Consider the proposition

A: Elements of X are incompatible.

Notice first that a proof of A must depend on an analysis of the elements of X. Otherwise the elements under consideration would not enter into reasoning, hence A could be demonstrated for any non-empty family of arbitrary items, which is impossible since some items are known to be compatible. But an analysis of the elements of X is also impossible, because these elements, as perfections, are simples. Hence A is not provable at all. Clearly it is also not known *per se*. But any proposition which is necessarily true is either demonstrable or known *per se*. Hence A is not necessarily true. Therefore it is possible that elements of X are compatible, hence they can be in the same subject. In conclusion:

4. A most perfect being, or a subject of all perfections, is possible.

Applying Cartesian reasoning we now obtain:

5. The subject of all perfections exists

– for existence is included among the perfections.

The above proof depends heavily on Leibniz's own complex and obscure theory of logical analysis, as also on his ideas of demonstration, definition, and necessity. Gödel's work in meta-mathematics calls into question, however, Leibniz's claim to the effect that all propositions necessarily true are either demonstrable or known *per se*. Moreover, if we observe that the reasoning in the key step 3 can be repeated also for the statement A: *Elements of X are compatible*, then the argument yields a rather anti-rationalistic conclusion, namely that the compatibility of all perfections is contingent, hence the nature of God is contingent, or – in meta-logical terms – some problems concerning this nature are undecidable by (finitary) logical means. The conclusion seems to deny Leibniz's early ontological necessitarianism. It is, however, in accordance with his later doctrine of contingence (cf. Rescher 1981, pp. 107–13). Finally, observe that Leibniz, like Descartes, took it for granted that existence is a perfection.

Gödel's Argument. The problem of perfection is notorious for its difficulties and obscurity. Leibniz's definition brought additionally the problem of simplicity. From the logical point of view it is easier to work with positiveness than with simplicity, and it is this idea that was taken up by Kurt Gödel in his now famous "*Ontologischer Beweis*". Here Gödel outlined a theory of positiveness formally developed in accompanying notes by Dana Scott. Both have recently been published as Appendices 2 and 3 in Sobel 1988 (cf. also Wang 1987).

Gödel presents a second-order theory of properties with two sorts of modalities: logical – *necessarily* (L) and *possibly* (M), applied to formulas; and ontological – *to be positive* (P), applied to properties. P(p) means: p is a positive property.

To produce properties from formulas we use the abstraction operator [ ]. For example, $\neg p = [x{:}\neg p(x)]$. This operator is characterized by the abstraction principle: $[x{:}p](y) \leftrightarrow p(y)$. The theory is axiomatized by taking the modal normal quantifier logic QK5 (cf. Chellas 1980) plus axioms characterizing positiveness and the notions: God-like being, essence, and necessary existence.

Pure Theory of Positiveness. We define:

$$p \leqslant q =_{\text{Df.}} \mathrm{L}\, \forall x(p(x) \rightarrow q(x))$$

As axioms we take:

A0 $P([x:x = x])$

The property of self-identity is logical, hence positive.

A1 $\neg P(p) \leftrightarrow P(\neg p)$

Either a property is positive, or its negation is positive, but not both.

A2 $p \leqslant q \rightarrow (P(p) \rightarrow P(q))$

Any property entailed by a positive property is positive, or: a property is positive if it necessarily contains a positive property.

A3 $P(p) \& P(q) \rightarrow P(p \& q)$

Conjunction of positive properties is also positive.

A4 $P(p) \rightarrow LP(p)$

Being a positive property is necessary.

According to Gödel, positive means: independent of the accidental structure of the world. Positivity is therefore purely ontological. It has also an obvious logical connotation: positive means: expressible by essentially positive formulas. On this interpretation axioms A0, A2, and A3 are evidently true. The axiom A1 follows from a typical rationalistic thesis to the effect that everything is *ontologically determined*, including well-defined collections and properties. This thesis is then applied to the property of positiveness. Note that A1 is equivalent to the condition stating that non-positiveness is explicable, i.e. that to be non-positive is to be logically equivalent to the negation of a positive property:

$$\neg P(p) \leftrightarrow \exists q(P(q) \& (p \leftrightarrow \neg q))$$

Finally, the rigidity axiom A4 expresses the idea that being a positive property is a purely ontological matter, and hence necessary.

Using only A0, A1, and A2 we may prove a very Leibnizian claim:

1. $P(p) \rightarrow M\exists x\, p(x)$.

Any positive property is possibly instantiated, hence possible, therefore consistent.

The Theory of God and Essence. A *God-like being* is defined as the subject of every positive property, in other words as a maximally positive being:

$$G(x) =_{Df.} \forall p\ (P(p) \rightarrow p(x)).$$

The *essential* (or *kernel*) property of a being x is defined by:

$$p\text{Ess}x =_{Df.} p(x) \& \forall q\ (q(x) \rightarrow p \leqslant q).$$

p is the essence of x if and only if x has p and this property is a kernel property of x, which means that p entails any property of x. Notice that the Gödelian idea of essence is rather unusual. It is similar to Duns Scotus's idea of positive formal properties, for instance *quidditas*, or in the case of individuals *haecceitas*.

Finally, *necessary existence* is defined by means of essential properties:

$$NE(x) =_{Df.} \forall p\ (p\text{Ess}x \rightarrow L\exists y\, p(y))$$

x necessarily exists if and only if its essence is necessarily realized.

The positiveness of the above properties is guaranteed by the last two axioms of the theory:

A5 P(G)
A6 P(NE)

Notice that in the presence of either of these two axioms the axiom A0 is superfluous. The axiom A5 is not contained in Gödel's hand-written notes but only in Scott's elaboration. We may try to derive it from A3 by means of an appropriate finiteness principle. The motivation for A5 given by Scott is as follows: to be positive is a *logical* property and G is defined logically as an intersection of positive properties, but any intersection of positive properties ought also to be positive.

The following further Leibnizian claims may now be proved:

2. $M\exists x\, G(x)$.
3. $G(x) \rightarrow G\text{Ess}x$.

The property G is kernel for a God-like being.

4. $p\mathrm{Ess}x \,\&\, q\mathrm{Ess}x \rightarrow \mathrm{L}\forall y\,(p(y) \leftrightarrow q(y))$.
5. $p\mathrm{Ess}x \rightarrow \mathrm{L}\forall y\,(p(y) \rightarrow y = x)$.

The correlation between a kernel property and its object is, *modulo* logical equivalence, one-to-one.

Finally we obtain the ontological theorem:

6. $\mathrm{L}\exists x\ \mathrm{G}(x)$..

A God-like being necessarily exists.

In fact, we may prove the stronger results (cf. Sobel 1988):

7. $\mathrm{P}(p) \rightarrow \mathrm{L}\exists x\ p(x)$.

Every positive property is necessarily instantiated, and

8. $\exists p\ p\mathrm{Ess}\ x \rightarrow \mathrm{NE}(x)$.

Any object with a kernel property necessarily exists.

The theory here outlined is more than an important addition to the investigation of the ontological argument – it is an important contribution to the general theory of properties. In particular, its ideas of essential property and necessary existence deserve independent attention.

The theory is based on the calculus QK5 axiomatized by adding the axiom:

$$\mathrm{MA} \rightarrow \mathrm{LMA}$$

to the minimal normal logic QK (cf. Chellas 1980). Notice that QK5 is weaker than the standard modal calculus QS5. The ontological theorem can also be obtained when we work with an alternative modal calculus QKR obtained from QK by adding the Leibnizian axiom:

$$(\mathrm{R})\ \neg(\mathrm{MA} \,\&\, \mathrm{M}\neg\mathrm{A})$$

which is to say: nothing expressible by a formula is contingent. In fact, using QKR and A1, A2, and A5 only, we can prove the ontological theorem 6.

Observe that A3, and *a fortiori* A6, are counterparts of Leibniz's basic claim concerning the compatibility of perfections, and this – as we remember – was the most important and delicate point in his argument. Thus, what Leibniz wanted to *prove* is now decided axiomatically. Therefore, Gödel's argument is Cartesian rather than Leibnizian.

Also Kant's objection is answered only in part. On the one hand, A6 lays it down that necessary existence is a positive property, but this, to meet Kant's objection, would have to be argued for, not decided axiomatically. On the other hand, the existence of God stated in the ontological theorem 6 is expressed by a quantifier not by a property, which raises the question whether the existential quantifier corresponds to a real property.

Recall that Leibniz limited the principle of identity to existing objects only (cf. Mates 1968); hence the unlimited use of self-identification in A0 is also non-Leibnizian. Moreover, Gödel's positive properties cannot be Leibnizian perfections, for the former, unlike the latter, need not be simple.

Gödel's theory is certainly consistent having a monistic model comprising one object, one atomic property, hence one world and, of course, one God. Furthermore, it is easy to build a natural extension of the theory which implies monism (cf. Perzanowski 1986). A property p is said to be *purely logical*, $\mathrm{PL}(p)$, only if it holds for any object. Any purely logical property is positive and hence a property of God. If, now, we decide also that any property of God, including the property *is identical to God*, is purely logical, then we at once obtain the monistic conclusion – that there is only one object.

This illustrates a close connection between God, if he exists, and the world. In a rather natural case the nature of God strongly determines the nature of the world.

Notice that positive properties are relative to logic and language. By A2 any purely logical property is positive; but nothing is decided in this respect as concerns contingent properties. For them any selection satisfying, in particular, axiom A1 is admissible. Such a selection does not, however, determine them uniquely. Gödel's God-like beings are de-

termined, rather, by the language and, in turn, by an appropriate selection of those of its elementary formulas which express properties.

Finally observe that by virtue of classical logic the property of being a God-like being is consistent, for classical logic limits the universe to consistent objects only.

The Argument from Degree of Reality. Leibniz, following Descartes, also used another concept of perfection:

> a degree of quantity of reality or essence, as *intensity* is a degree of quality, and *force* is a degree of action. It is clear, also, that existence is a perfection or *increases reality*, that is: when A is thought as *existing*, more reality is thought of than when A is conceived as *possible* (op. cit., p. 177 [emphasis added]).

Thus *perfections increase reality*, an idea which opens the way to a new ontological argument.

As perfections are qualities we start with a very rudimentary theory of qualities. We distinguish, first of all, qualities from properties. Qualities *determine* or *frame* objects (like *spin* of an electron or *Platonicity* and *wisdom* of Plato) whereas properties *characterize* or *describe* them (as *redness* of a red sweater).

We work with two languages: propositional for qualities and predicative for properties. Qualities are denoted by propositional signs: p, q, r, etc.; properties by corresponding predicate letters: $p(\ ), q(\ )$, etc. The letters x, y, z are used to denote *things*, i.e. anything which *can* be determined or characterized. *Objects* are items in general, i.e. anything which is determined or characterized, or which determines or characterizes; things, qualities, and properties are all of them objects.

$Q(x)$ is the family of all qualities of x, its frame. $p \epsilon Q(x)$ means that p is a quality of x, where $p(x)$ means that the corresponding property $p(\ )$ is a property of x (and is thus instantiated by x). The question when properties correspond to qualities will be discussed later.

Beings are determined things, i.e. subjects of certain qualities; x is a being if and only if $Q(x) \neq \emptyset$. Beings are not necessarily consistent; consistent beings are called *proper* beings.

We are looking for the general conditions on an acceptable notion of logical consequence. Let C denote some arbitrary but fixed consequence operator on the propositional language of qualities. We shall deal both with consistent (coherent) and with inconsistent (incoherent) objects, therefore the consequence C should indicate when a given set of formulas is consistent. Now, x is said to be *consistent* if and only if $Q(x)$ is consistent. Notice that to have *many* inconsistent objects we must work with a non-classical logic, preferably a paraconsistent one.

We should like as far as possible to work with classical logic, but we shall not limit ourselves to this. Axioms on an acceptable notion of logical consequence are as follows:

L1 (*Preservation*) C preserves both consistency and inconsistency, i.e. for any set of formulas X, if X is consistent, then C(X) is also consistent, and C(X) is inconsistent only if X is inconsistent.

L2 (*Minimality*) The minimal C-logic is non-empty and consistent: $C(\emptyset) \neq \emptyset$ and $C(\emptyset)$ is consistent.

$C(\emptyset)$ is the family of all *purely logical* qualities, denoted also by PL. By L2 it is non-empty and consistent. Observe that, by L1, instead of consistency of $C(\emptyset)$ we can assume that $\emptyset$ is consistent.

Axioms on Qualities. Let a suitable logical consequence satisfying L1 and L2 be fixed. We now have:

Q1 (*Closure*) $Q(x)$ is logically closed: $C(Q(x)) = Q(x)$.

Q2 (*Leibniz's Principle*) Different things differ in their frames: $Q(x) = Q(y) \rightarrow x = y$.

Q3 (*Comprehension*) For any family of qualities X there is an x such that $X \subseteq Q(x)$.

Q4 (*Instantiation*) If x is consistent and $p \epsilon Q(x)$, then $p(x)$.

Notice the weak, or general, form of the Comprehension Axiom: neither the unique-

ness of x nor the identity of X with some frame is assumed, but only the 'realization' of X by x. Comprehension is notorious, among people believing that *everything* is consistent, for its power to introduce inconsistent items. Leibnizians, however, even if devoted to consistent objects, try to study both consistent and inconsistent ones, in search of proofs of the consistency of objects under consideration (including God). Therefore comprehension has been introduced in its full generality.

We can now prove:

1.1. There is at least one proper being, namely the purely logical being.
1.2. If Q, the family of all qualities, is inconsistent, then there is at least one improper being, namely the *full* defined by $Q(x) = Q$.

The full, however, is consistent, if Q is consistent. Moreover, by Q1–Q3 we have as many consistent (or inconsistent) beings as we have different logically closed consistent (or inconsistent) families of qualities. Notice that *nothingness* (i.e. an x such that $Q(x) = \emptyset$) is, by L2 and Q1–Q3, excluded – for otherwise $\emptyset = Q(x) = C(Q(x)) = C(\emptyset) \neq \emptyset$.

Observe also that instantiation of qualities by their subjects is assumed only for proper beings – cf. Q4. Hence the qualities of consistent things are their properties (but not necessarily *vice versa*).

Particularizations. For a given quality p and thing x, the *p-particularization* of x, denoted by x_p, is defined by taking as its frame the logical closure of the frame of x enriched by p: $Q(x_p) = C(Q(x) \cup \{p\})$.

Particularization can destroy consistency. If p is consistent with respect to $Q(x)$ then x_p is also consistent.

We can now easily prove

2. If $p \in Q(x)$ then $x = x_p$.
3. For any x and p, x_p exists and is unique.

Existence follows by Comprehension, uniqueness by Leibniz's Principle.

Notice that for any x and p, $p \in Q(x_p)$, but $p(x_p)$ is guaranteed only for consistent x_p.

Perfections. To express the idea that *perfections increase reality* we introduce a relational *scale* (DR, $<$) on which a *measure* has been defined. DR is a non-empty collection of items called *degrees of reality* equipped with a suitable relation $<$ comparing degrees. A measure is a mapping which maps things into degrees. We let $|x|$ stand for the degree of reality of x according to the given scale and measure.

Observe that the scale (DR, $<$) can be considered as a relational frame for modal logic (cf. Chellas 1980), determining a suitable modal logic. Thus our measuring implicitly imposes a modal structure on the universe.

We assume the following, very intuitive, limitation on measures:

P1 (*Limitation*) If x is consistent and y is inconsistent then $\neg(|x| \leqslant |y|)$. No inconsistent object is more real than a consistent one.

A *perfection* is now defined as any quality the possession of which does not decrease reality:

$$PF(p) =_{Df.} \forall x\, (|x| \leqslant |x_p|)$$

Observe that:

4. $PL \subseteq PF$, hence $PF \neq \emptyset$.

God-like beings. These are defined as the subjects of all perfections:

$$g(x) =_{Df.} PF \subseteq Q(x).$$

By Comprehension we have:

5. There are god-like beings: $\exists x\, g(x)$.

As a matter of fact, there are quite a lot of them. Namely, for any x we can obtain its god-like counterpart x_g by putting:

$$Q(x_g) = C(Q(x) \cup PF).$$

Consistent god-like beings are called *gods*. *God*, G, is the god-like counterpart of the purely logical being, i.e. we have:

$$Q(G) = C(PF).$$

By definition God is the most perfect being. We will prove, step by step, that G is consistent, unique and maximal.

Consistency. First, let us observe:

6. For any perfection p and proper being x, x_p is a proper being also. Thus particularization by means of perfections (*perfectionization*) preserves consistency.

Otherwise, we would have that for some x and p, x_p is inconsistent. But $|x| \leqslant |x_p|$, as p is a perfection, which contradicts P1.

In fact by iteration we can generalize 6. to any *finite* family of perfections:

7. For any finite family P of perfections and any consistent x, x_P is also consistent.

Let z denote the purely logical object. By 7. any finite approximation of God, i.e. any z_P for a finite $P \subseteq PF$, is consistent. The consistency of God can be obtained, now, either by a suitable Finiteness Principle or by means of the Anselmian generalization of the definition of perfection:

P2 (*Anselmian Maximalization*) For any x and $P \subseteq PF$, $|x| \leqslant |x_P|$.

As a matter of fact, a P2-type principle is the crucial step in any *proper* ontological argument.

Applying P1 and P2 we obtain:

8. G is a proper being, i.e. God is consistent.

Notice, that in spite of the possible multiplicity of god-like beings, God is, by Leibniz's Principle, unique.

Maximality. It seems natural to assume that increasing the number of qualities decreases reality. Hence we have

P3 (*Regularity*) $Q(x) \subseteq Q(y) \rightarrow |y| \leqslant |x|$.

From this we immediately obtain:

9. The purely logical being is maximal: $\forall x\ |x| \leqslant |z|$.

Applying P2 we obtain:

10. God is the maximal being: $\forall x\ |x| \leqslant |G|$

provided that:

P4 (*Transitivity*) The order $\leqslant$ is transitive.

In conclusion we can prove from L1 and L2, Q1–Q3, and P1–P4 the following:

11. (*Ontological Theorem*) There is a consistent, maximal and unique being which is the most perfect proper being.

Reduction. x and y are said to be *compatible* if and only if x and y are either both consistent or both inconsistent. To reduce the plurality of god-like beings we must introduce a suitable axiom:

P5 (*Reduction*) If x and y are compatible and $PF \subseteq Q(x) \cap Q(y)$ then $x = y$.

This reduces the number of god-like beings to at most two: the inconsistent god-like being, and God.

Existence. Let e denote the quality of existence. Is it a property of God? Is it a perfection? We start with an axiom characterizing existence as a quality increasing the reality of *consistent* objects:

E1 If x is consistent then $|x| \leqslant |x_e|$.

We now define G_e by putting

$$Q(G_e) = {}_{Df.}\ C(Q(G) \cup \{e\}).$$

By E1 and P1 we have:

12. $|G| \leqslant |G_e|$ and G_e is consistent.

Obviously $e \in Q(G_e)$; therefore by the instantiation axiom Q4, $e(G_e)$. Using reduction P5 we obtain that $G = G_e$, hence:

13. Existence is a property of God: $e(G)$.

Another proof to the same effect follows from the maximality of God plus the following intuitive principle:

E2 If $|x| \leq |y|$ and $e(x)$ then $e(y)$.

Is existence a perfection? It is, if we assume additionally that the family of all perfections is logically closed (hence that God is the subject of all and only perfections):

P6 $PF = C(PF)$.

Notice that P6 is a counterpart of Gödel's axiom A1.

The above definitions of perfections and God, and the reasoning itself, clearly depend on the assumed logic of qualities and on the scale $(DR, <)$ with its conjugate reality measure. The God of the theory is to this extent *relative* to logic, scale, and measure.

The proof develops the rationalistic idea that the universe is organized and ordered according to some hierarchy. The Ontological Theorem clarifies, at least, the role of God in such a universe.

The ontology of God suggested by it is based on science, logic, and mathematics. According to the proof, to discover God is to find the type of scale enjoyed by reality and the proper logic of qualities. This can be done only by research. Therefore, if human beings will continue to be successful in their search for truth, then they could find the very perfections, discovering thus the principal traits of God.

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JERZY PERZANOWSKI

Ontological Commitment

This term is due to W. V. O. Quine, who has given the best-known and most widely accepted test of ontological commitment in terms of quantification: "The universe of entities is the range of values of variables. To be is to be the value of a variable." ("Designation and existence", *The Journal of Philosophy* 36 (1939), p. 708.) Without presupposing Quine's own view, we may define ontological commitment generally as follows:

> A class of sentences (typically a theory) is ontologically committed to those entities which must exist if all the sentences in the class are true.

Ontological commitments typically depend on the theory of truth and reference associated with the language whose sentences are in question. For a simple subject–predicate sentence like 'Socrates is mortal', a realist about universals, such as Thomas Aquinas, would say its truth requires the existence of Socrates and mortality, whereas an anti-realist about universals, such as William Ockham, would say it requires the existence of Socrates only, he being one among the one or several individuals designable as mortal. For Gottlob Frege the sentence's truth requires the existence of Socrates, the truth-value True, and a concept (function from objects to truth-values). Others would follow a Russellian view and say its truth requires the existence of a fact or state of affairs of Socrates' being mortal.

Quine's criterion offers a uniform test for ontological commitment: "entities of a given sort are assumed by a theory if and only if

some of them must be counted among the values of the variables in order that the statements affirmed in the theory be true" (*From a Logical Point of View*, 103). This may be illustrated by an example. Consider a language using predicate logic with no individual constants, only predicate constants. If from a set of sentences S in this language the sentence '$\exists x.M$' logically follows, then S is ontologically committed to the existence of entities x such that M. For example, the Peano axioms for arithmetic are committed to the existence of prime numbers greater than a million. The sentence '$\exists x.x$ is prime $\wedge$ $x > 1000000$' means '*there is* something prime and greater than a million'; it says things of a certain kind exist, and its semantic interpretation requires that there be a range of objects in which the bound variables take values, of at least one of which the complex predicate 'is prime and greater than a million' is true.

Quine's view results from the more general characterization under several assumptions:

1. that an adequate and perspicuous language is provided by a form of predicate logic;
2. that names are no reliable guide to ontology;
3. that existence is best expressed by the existential quantifier;
4. that quantifiers have an objectual interpretation.

Despite Quine's insistence on the triviality of his criterion, each of these assumptions has proved controversial.

Against 1., it has been noted that languages of equivalent expressive strength to predicate logics may dispense with bound variables in favour of combinators, and that Quine himself has proposed such languages; how then can commitment be tied to variables? Quine's reply is that equivalent languages have the same commitments, the familiar predicate–variable versions simply showing these most clearly.

Also against 1., it has been contended that extensions of predicate logics using modal operators and other intensional devices are required to express kinds of claims not expressible in predicate logic. Quine's reply is to maintain extensionalism and question the coherence of modal logic. Alonzo Church, however, pointed out that Quine's criterion (note the 'must' in its formulation) is non-extensional: "ontological commitment to unicorns is evidently not the same as ontological commitment to purple cows, even if by chance the two classes are both empty and therefore identical" ("Ontological commitment", *The Journal of Philosophy* 55 (1958), p. 1013n.).

Against 2., it has been contended that names are not dispensable in the way Quine claims, which involves replacing names (e.g. 'Socrates') by corresponding predicates ('socratizes') true of just one individual. Quine's reply is that he is not concerned with ordinary language but with its regimentation, and that the artificial device is an acceptable theoretical simplification. That the mere presence of a name in a language does not guarantee it a denotatum is generally accepted.

Against 3., it has been pointed out that in some logical languages the 'particular' quantifier $\exists$ does not express existence, for example in Stanisław Leśniewski, or in the languages of Meinongians. In each case, a sentence '$\exists x.x$ does not exist' would be regarded as true. Quine has deplored the distinction between being and existence and would no doubt contest the coherence of the idea of objects outside being.

Against 4., we may note Leśniewski's readiness to quantify variables other than individual while denying ontological commitment to corresponding entities. This attracted Quine's criticism in 1933 (Quine, *The Time of My Life*, 1985, p. 104). For Quine, quantifying variables of a category effectively nominalizes these and incurs commitment to reified entities in the range of the variables. Against this, Arthur Prior and others have denied that quantification involves nominalization. If it is accepted that the truth-conditions of quantifier sentences require variables to range over entities, without requiring these always to be nameables, we have what may be called a *referential* account of quantifiers which is yet not *objectual* (Quine would deny the distinction, of course). A referential, non-objectual account of Leśniewskian

quantification has been proposed by Guido Küng and John T. Canty.

An alternative account of the truth-conditions of quantifier sentences uses the *substitutional interpretation*. According to this, a sentence of the form '$\exists x.M$' is true iff there is an expression such that the sentence obtained from M by uniformly substituting it in place of 'x' is true. Quine has objected to this that it makes claims about the world dependent on the availability of expressions, so e.g. in a language with only denumerably many real number terms, it would be wrong to say there are non-denumerably many real numbers. Where enough names are assumed, the oblique ontological commitments (to names) are no less than they are for the objectual interpretation. Quine is prepared, following Charles Parsons ("A plea for substitutional quantification", *The Journal of Philosophy* 68 (1971)), to accept substitutional quantification for those parts of mathematics (higher set-theory) which he is not prepared to take ontologically seriously, maintaining that substitutional quantification is no guide to ontology.

It should be stressed that even if Quine's criterion is accepted, it does not decide what ontology is to be adopted. At best, the criterion enables one to elicit the commitments of a particular theory and may thus assist in the decision. Quine's own ontology of classes is rejected by many who accept his criterion.

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PETER M. SIMONS

Ontologism

Ontologism was, together with traditionalism, the principal trend in Italian philosophy during the 19th century and before the resurgence of Thomism. It was represented both by committed Catholics such as Antonio Rosmini (1797–1855), from whose voluminous works forty 'ontologist' propositions were later 'reproved, condemned and proscribed' by the Holy Office, and by ultimately anti-clerical pantheists such as Vicenzo Gioberti (1801–52), all of whose theorizing was coloured by rationalism. Thus Gioberti adopts Hegel's saying that "logic . . . is nothing but creation" and teaches that being, or reality, is present to the mind *as* thought. Thought is thus to be seen not as simply a property of mind, but as being itself. In effect the order of being and the order of knowledge are assumed to be identical, this being perhaps the core tenet of ontologism. Hence thought must start with God, and a direct intuition of the divine is postulated, which tends logically to pantheism, "the only true and sound philosophy" (Gioberti).

This belief in a human capacity for a direct intuitive relationship with and even vision of the Absolute or Infinite Being can be traced back at least to the Cartesian doctrine of innate ideas, particularly the idea of the infinite. Like René Descartes in his Third Meditation ("my primary perception is rather of the infinite than of the finite"), the ontologists deny that this idea can be obtained through abstraction from finite beings. Rather they see knowledge of what is finite as itself depending upon this *intuition* of the infinite, i.e. of God.

Thus Orestes Brownson (1803–76) wrote:

> The universal, the necessary, the eternal, the immutable, without the intuition of which the contingent and the particular are inconceivable, and no syllogism is possible, are identically the divine being, the *ens necessarium et reale*, or God himself (*Boston Quarterly Review*, October 1860).

The ontologists here oppose the Thomist doctrine that knowledge of God can only be by analogy with our knowledge of finite things, i.e. it comes *afterwards* and dependently. In coming to know, if we do, that God must exist first, we do not, a Thomist would say, necessarily first know his existence, or only see creatures because we see the divine essence. The ontologists indeed, as part of their identification of being and knowledge,

equate what they call the universality, necessity, and eternity of our concepts and judgements with these same attributes of the divine being, as if necessary divine existence were the same as an idea's being the subject of necessary relations or as if universal divine being were no more than an idea's being indefinitely applicable to individuals.

With this conflation of universals with the divine ideas, ontologists naturally have their own approach to the historical problem of universals as in some way constituting the natures of singular things. But if what constitutes these natures *is* the divine nature, as identical with the divine ideas but hence, for the ontologists, with universals (and here they go beyond even Platonic realism), then pantheism is once more necessarily implied.

Ontologism, as the example of Brownson suggests, was not limited to Italian philosophy, but arose independently elsewhere and can indeed be cogently argued to be first cousin to Feuerbachian atheism, where an exclusively immanent God ceases to be God. In the Catholic world an at least equally eloquent and, it seems, independent propagator of ontologist ideas was Casimir Ubaghs (1800–75), who made Louvain after 1830, when he moved there from Rolduc in the Netherlands, the ontologico-traditionalist centre. From there also after 1846 he edited the semi-official organ of ontologism, the *Revue catholique*. It was seven propositions from his works, in fact, that the Roman Holy Office first censored (1861), though merely as being 'unsafe for teaching', as if they hesitated to condemn an author who taught that the intelligence contemplates God directly and all else in him. Four of the propositions were (H. Denzinger, *Enchiridion Symbolorum*, 1659–65):

1. The at least habitual immediate knowledge of God is essential to the human intellect in that nothing can be known without it, for it is the intellectual light itself.
2. *Esse commune*, i.e. common being, is the divine *esse*.
3. Universals in themselves are not really distinct from God.
4. The innate knowledge of God as simply being implicitly involves all other knowledge *eminenti modo*.

Ontologists often appealed to Nicolas Malebranche for support, taking his work, as he did himself, as a reflection of that of Augustine. However the Catholic 19th-century ontologists generally maintained against Malebranche that concrete material things are perceived by our senses (Ubaghs, *Essai d'idéologie ontologique*, 1860). But following Malebranche they attempted to distinguish between perceiving universal ideas in the divine essence as such (which would amount to the vision of God) and seeing them in this essence as the archetype of creation. This might seem to be no more than a logical distinction, though, which – in saying that what we see now is first of all God – would seem to amount to denying God's reality as ordinarily understood. Ontologism covers a basically monist immanentism with a veil of religious language generally reserved for transcendence.

If we consider Augustine, to whom Malebranche and the ontologists appeal, it is certainly true that he identified the Platonic forms with the divine ideas (*83 Questions*, 46) and, like Thomas Aquinas, he denied to these a separate existence outside of the divine simplicity. For Augustine

> the forms – now ideas in the divine mind – yield their eternal truth to the mind in the light of a divine illumination of the mind. This is an exact replica of Plato's image of the sun: for Augustine, too, God is to the mind what the sun is to the things visible to the eye (A. H. Armstrong and R. A. Markus, *Christian Faith and Greek Philosophy*, London, 1960).

Such participation of natural reason in the divine light, as Aquinas (himself interpreting Augustine) expounds it, is not the same as the ontologists' conflation of the two. "Just as we see sensible things without seeing the essence of the sun, so we can see things intellectually without seeing the essence of God", even though we can say we see and judge all sensible things "by the light of the sun" (*Sum. Theol.* Ia 12, 11 ad 3; cf. Augustine, *Confessions*, XII, 25). We cannot see God in this life because our souls have their being in

corporeal matter, "hence they cannot by nature know anything except what has its form in matter or what can be known through such things" (ibid.). The soul, Aquinas claims, does not intuit itself directly in this life. For ontologism, however, "nothing remains (to avoid pantheism) but to admit that the soul has, by one and the same act, an intuition of God and itself" (Brownson), a passage close to, but not the same as, John Henry Newman's (and Augustine's) doctrine of God and the soul as the two certain realities.

The roots of ontologism as a phenomenon in modern culture seem then to lie more in Cartesianism than in Augustinianism. F. Copleston (*History of Philosophy*, London: Newman, 1946) mentions Augustine's "adoption of Platonic . . . expressions which do not, literally taken, fit in with the general direction of his thought", pointing out that his argument to God's existence from eternal truths assumes that one can know the one without the other, as it seems ontologists would have to deny. For Augustine, as for Thomas Aquinas, God is not *esse commune* (common being), but is identical with his own unique *act* of being, shared by no creature (Leo Elders 1985). The acts of being (*actus essendi*) of created things only imitate this divine act, upon which of course they causally depend. Even Plato only said creatures *remind* one of the Absolute. Such a level of participation is only analogous to the real sharing in the divine life contemplated in Catholic belief as a result of grace alone and not at all as a philosophical truth. Ontologism resulted, apart from the influence from modern thought discussed here, from not purging the participation doctrine of ambiguity.

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STEPHEN THERON

Ontology
I: History of Ontology

The term 'ontology' can be considered from at least two points of view. Ontology is a philosophical discipline which can be defined either according to its object (for example *ens*, *Ding*, object, being) or in relation to other philosophical or non-philosophical disciplines, such as speculative metaphysics and science, or epistemological disciplines which could be termed 'epistemological', such as logic, methodology, or theory of knowledge.

These two systematic aspects can already be found in the work of Rudolphus Goclenius, also called Göckel, in whose work we find one of the first occurrences of the term 'ontology'. In his *Lexicon philosophicum* (1613), the expression 'ontology' appears in connection with the *abstractio materiae*. This abstraction is either *physica* (from singular matter), *mathematica* (from singular and universal matter, not really but only conceptually), or *transnaturalis* (from every matter, really and conceptually).

Here mathematical abstraction is more precisely defined as follows:

> The separation and abstraction from matter is [secondly] from *singular* [*matter*] *as well as from universal* [*matter*], but only conceptually (*secundum ratione*), such as [abstraction] from simple or mixed bodies. This [abstraction] is *mathematical*, and ontological (ὀντολογικὴ), i.e. related to philosophy of being or of transcendentals.

The following comment appears in the margin of this text: "ontologia or philosophia of BEING".

Thus, ontology is associated with the science of being, and according to Goclenius, the science of being as being is metaphysics. On the other hand, mathematics and physics are subordinated to this metaphysics and consider only being from a limited point of view (*sub ratione contracta*) (see Goclenius *Lexicon*, articles "Abstractio materiae" and "Ens seu quod est"). Hence, although ontology and mathematics consider being by abstracting from both singular and universal matter, ontology considers being as being, and mathematics considers only a special kind of being.

In 1620, the Calvinist Johann Heinrich Alsted (1588–1638) takes up the term 'ontology' and identifies ontology with metaphysics or 'first philosophy' as 'general discipline of being'. This ontology has a general part which deals with *transcendentia* and a special part which deals with *praedicamenta* (categories). Alsted opposes this general discipline or ontology to inferior disciplines which are concerned with special beings (such as physics with natural bodies, mathematics with quantity), as well as to the science of transnatural beings, which he calls *pneumatica* or *pneumatologia*, the science of God, angels, and separate souls. Metaphysics or ontology is the most general discipline, which cannot have a double subject (being and God) (*Cursus philosophici Encyclopaedia*, 1620, Lib. V–VI).

Johann Micraelius (1579–1658) departs from the reduction of metaphysics to the science of being as being and sees it as embracing also the special sciences of pneumatology (theology, angelography, psychology). These he opposes to ontology as the general part (see the articles "Metaphysica" and "Philosophia" in his *Lexicon philosophicum* of 1653). Micraelius thereby seems to coin the distinction between *metaphysica generalis* and *metaphysica specialis*, a distinction which has been current ever since.

The notion of 'ontology' was also affected by Cartesianism. Johannes Clauberg distinguishes three kinds of *entia*: being as thinkable (*ens cogitabile*), being as something (*aliquid*), and being as thing or substantial being (*res sive ens substantiale*). Ontology or 'ontosophy' deals with being in the third sense and it presupposes the science of thinkable things, in other words metaphysics or 'first philosophy', as this is elaborated in René Descartes's *Meditationes* (*Metaphysica de Ente, quae rectius Ontosophia*, 1664, I, 1–5).

Traces of this same distinction, between ontology and a science or method of thought, appear also in the 18th century, for example in the work of Christian Wolff and in Kant. According to Wolff, ontology deals with being in general, but it can also be termed 'first philosophy' in so far as it concerns first principles and notions 'which are used in reasoning'. The method of ontology conforms to that of mathematics (*Philosophia prima sive Ontologia*, 1730, "Prolegomena").

Kant identifies ontology (the system of all those concepts and principles of reason which relate to objects in general) with the first part of the system of his metaphysics of nature. Ontology in this sense presupposes the method or propaedeutic of the critique of pure reason, the knowledge of the limits of human knowledge. Kant's reformed ontology is concerned only with objects which are accessible to human knowledge (appearing objects, ontology of 'immanent thought') and it is based on the principles of this knowledge developed by Kant in his 'analytic of the pure understanding' (*CPR*, *Letter to Beck*, 20 January 1792). (On the relations of methodology, metaphysics, and ontology, see also Johann Friedrich Herbart, for example *Kurze Enzyklopädie der Philosophie*, 1831, II, § 190, and Lotze).

Also in the 18th century, the German tradition tends sometimes to locate the object of ontology in the essence of things, rather than in the things themselves. In Wolff's work, this transformation becomes manifest in the fact that the first thing conceived in being is not existence, but essence (*Philosophia prima*, § 144). In Christian August Crusius, ontology becomes explicitly a science of the 'general essence of things', and he sees this essence as something to be analysed entirely *a priori* (*Entwurf der notwendigen Vernunftwahrheiten*, 1745, 1, § 5; see also Georg Bernhard Bilfinger, (1693–1750), Johann Heinrich Lambert, and Hegel).

As for the relation between metaphysics and ontology, Wolff (*Philosophia rationalis*, "Discursus praeliminaris", §§ 79, 99), Crusius (*Entwurf*, 1, § 5), and Kant (*CPR*, *Reflection* 4851) remain faithful to the distinction between general metaphysics (ontology) and special metaphysics (psychology or pneumatology, cosmology, theology).

In the 19th and 20th centuries, the evolution of the notion of 'ontology' can again be analysed in terms of the distinction between the object of ontology and the relation of ontology to other disciplines. The relation between ontology, 'epistemological' sciences

and metaphysics is discussed by authors such as Rudolf Hermann Lotze, Nicolai Hartmann, and Günther Jacoby (1881–1969).

In Lotze's view, the system of philosophy contains logic and metaphysics. Logic is concerned with thought (pure logic), with investigation (applied logic), and with knowledge (methodology). Contrary to this science of the thinkable, which has eternal validity, metaphysics deals with reality and its relations, in other words with the changeable world or with being 'which is beyond thought'. This metaphysics includes ontology (the doctrine of being and of the relations of all that is real), cosmology, and psychology (*System der Philosophie*, 1874–9, I).

In Nicolai Hartmann's work, ontology is defined in relation to metaphysics as well as to a theory of consciousness. Ontology, which deals with *Sein* or *Seiendes*, must be distinguished from 'gnoseology', which deals with consciousness. Gnoseology is the *ratio cognoscendi* of ontology (all that we know of being comes from gnoseology), whereas ontology is the *ratio essendi* of gnoseology (knowledge itself is one kind of being, and therefore it is an object of ontology). Hartmann's ontology is a critical metaphysics which constitutes an intermediate position between the usual realistic and idealistic standpoints. Realistic ontology admits that reality is constituted just as it is represented by its image in knowledge, whereas idealistic ontology admits exactly the opposite. Critical ontology or metaphysics admits that there is real being beyond thought, but that its image is neither inadequate nor complete (*Grundzüge einer Metaphysik der Erkenntnis*, 1922).

According to Günther Jacoby, ontology is the theory of the most general formal relations of reality. This ontology considers only the object of knowledge, not the way in which knowledge is obtained, so that ontology and theory of knowledge must 'be rigorously distinguished'. On the other hand, ontology is distinguished also from metaphysics, which is a doctrine of the suprasensible. Ontology itself deals only with sensible (immanent or transcendant) reality (*Allgemeine Ontologie der Wirklichkeit*, 1925).

Another tendency appears around 1900 in Edmund Husserl's work and consists in considering ontology as a doctrine of the object in the broadest sense, including 'real' objects as well as abstract, mental, or ideal objects. Johannes von Kries (1853–1928) distinguished ontological judgements (concerning *Gebilde* or formations or structures of reality) from nomological judgements (concerning relations between realities) (*Prinzipien der Wahrscheinlichkeitsrechnung*, 1886). Fourteen years later, Husserl takes up this terminology and draws a distinction between ontological (or concrete) and nomological (or abstract) sciences (*Logische Untersuchungen*, 1900–1, "Prolegomena", § 64). It is only in 1913 in his *Ideen* I that he introduces the term 'ontology' for the eidetic science of object in general (formal ontology) and of regional objects (material ontologies) (see also *Log. Unt.*, 1913, 2nd ed., III, § 11).

This extension of ontology to objects in the broadest sense is partly explained by the appearance of Alexius Meinong's *Gegenstandstheorie*. According to Meinong, the theory of objects is an *a priori* science which concerns the whole of what is given. Metaphysics on the other hand considers the latter only *a posteriori*, in other words it considers *reality*, which is to say existent or actual objects. Existent objects must be distinguished from subsistent (*bestehend*) or ideal objects, such as identity, diversity, or number. Existence and subsistence are the two forms of being, whereas the 'pure object' considered in the theory of objects is beyond being and non-being (*Über Gegenstandstheorie*, 1904).

On the basis of this conception, Meinong's disciple Hans Pichler (1882–1958) identified ontology with the theory of objects and defined it as a science of objects analysed independently of their being and non-being (*Über Christian Wolffs Ontologie*, 1910). (On the historical relations between the term 'ontology', Meinong's theory of objects and Husserl's ontology, see also Husserl, *Ideen*, I, § 10, note 2.) For a view closely related to these approaches to ontology, see also Roman Ingarden, who conceived ontology as the *a priori* science of possible orders of existence, and metaphysics as the *a posteriori* science which would determine which of

these possibilities is in fact realized (*Streit um die Existenz der Welt*, 1964–5, I).

In the 20th century, Meinong's distinction between existence and subsistence, being and non-being has been rejected by W. V. O. Quine (see *From a Logical Point of View*, 1953; *Ontological Relativity and other Essays*, 1969). Ontology does not consist in knowing what there is, but in knowing what a given remark or doctrine *says* there is. Thus, we 'commit' ourselves to an ontology when we say that there are centaurs, but we do not when we say that centaurs are *not*. A doctrine which says that there are objects beyond being and non-being does not conform to Quine's criterion of ontology. A theory is committed to those and only those entities to which "the bound variables of the theory must be capable of referring in order that the affirmations made in the theory be true". The Platonists commit themselves to an ontology containing universals named by words (variables of existential quantification range over universals), whereas the nominalists and Quine hold that "such appeal to a realm of entities over and above concrete objects in space and time is empty verbalism, devoid of explanatory value" ("On universals", *Journal of Symbolic Logic*, 1947; "On what there is", *From a Logical Point of View*).

The most original transformation of the notion of 'ontology' in the 20th century, however, almost certainly occurs in the early Martin Heidegger, through the introduction of an ontology of *Dasein*. According to Heidegger, traditional ontology deals exclusively with categorical determinations of being (*Seiendes* as *Vorhandenheit* and *Zuhandenheit*), whereas his ontology is to deal with the being (*Sein*) of all beings on the basis of the ontology of human being (*Dasein*) which understands being (*Sein*) ('fundamental ontology'). Phenomenology is the method of ontology. It is concerned with the *how*, and not with the *what* of philosophical investigation (*Sein und Zeit*, 1927, *Grundprobleme der Phänomenologie*, 1927). On the relation between ontology and metaphysics, see also Jean-Paul Sartre (*L'être et le néant*, 1943, "Conclusion").

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LÉO FREULER

Ontology II: Formal Ontology

Formal ontology is the result of combining the intuitive, informal method of classical ontology with the formal, mathematical method of modern symbolic logic, and ultimately of identifying them as different aspects of one and the same science. That is, where the method of ontology is the intuitive study of the fundamental properties, modes, and aspects of being, or of entities in general, and the method of modern symbolic logic is the rigorous construction of formal, axiomatic systems, formal ontology, the result of combining these two methods, is the systematic, formal, axiomatic development of the logic of all forms and modes of being. As such, formal ontology is a science prior to all others in which particular forms, modes, or kinds of being are studied.

Logic can be distinguished from formal ontology, but only in the sense of logic as an uninterpreted calculus, i.e. as the method of constructing abstract formal systems subject to varying interpretations over varying domains. A formal system in which logical (or syncategorematic) constants can be distinguished from non-logical (or categorematic) constants and in which the axioms and rules are assumed to be logically valid is not an uninterpreted calculus, however, but a *logistic system* in which logic is a language with content in its own right. The defining characteristic of a logistic system is that it propounds a theory of logical form, which comprises both a pure *logical grammar*, i.e. a

system of categories and rules for generating meaningful expressions, and a system of *logical axioms and rules* that determine the deductive relations between different sets of expressions of that grammar. The purely formal or non-descriptive content of such a system, while independent of the existence of any and all physically real individuals or of the natural properties and relations that such individuals might have in nature, is not independent of the different modes of being of such entities, and in fact presupposes such modes in its very articulation.

Edmund Husserl was among the first to characterize a logistic system in this way, and it was he who also first introduced the notion of a formal ontology. For Husserl, logic has both an apophantic (assertional) aspect, which he called formal apophantics (and which amounts to a theory of logical form as characterized above), and an ontological aspect, which he called formal ontology. The switch from a formal-apophantic attitude to an ontological one is achieved primarily through a process of nominalization, and the underlying unity of the two aspects is given through a 'Law of Denominative Equivalence', according to which the well-formed expressions of any given category may be transformed into corresponding nominal forms. It is in this way, for example, that propositional forms and their predicative components (as generated in the theory of logical forms) are transformed into nominal forms that stand for states of affairs and properties and relations, respectively. The 'categorial objectivities' or 'correlates' that originate from such 'denominative reductions' (or nominalizations) of the pure forms of apophantic logic are then claimed to make up the fundamental conceptual material of formal ontology (cf. *Logical Investigations*, Volume I, §§67–8, *Ideas*, §119, and *Formal and Transcendental Logic*, Chapter 2, §25).

The important connection of ontology with a logistic system is that the logico-grammatical distinctions made in the latter are based ultimately on a distinction between different modes of being, even if that distinction is initially described in terms of different modes of significance. More is required by way of comprehensive grasp, however, before a logistic system can be taken as a system of logic or a formal ontology in its fullest sense. In particular, such a logistic system must be rich enough to contain, when suitable non-logical constants, axioms, and meaning postulates (regarding such constants) are added to it, every scientific theory and the logical analysis of every meaningful declarative sentence of any natural language. In that case such a logistic system can be taken as a *lingua philosophica*, or what Leibniz also called a *characteristica universalis*, and as such it is also none other than a comprehensive system of formal ontology.

Such a comprehensive system of formal ontology will in general have different branches or sub-systems within which different ontological tasks can be carried out. One such branch, for example, would be a theory of parts and wholes, which would include a relation of foundation regarding how some parts are founded or dependent upon other parts or wholes. (Cf. Husserl *Logical Investigations*, Volume 2, Investigation III, and Barry Smith 1982.) There would also be a theory of extensive and intensive magnitudes, i.e. a measurement theory, and a theory of continuants and of the existence of the latter in space and time. (Cf. Franz Brentano, *The Theory of Categories*.)

Corresponding to different philosophical backgrounds, there may be different alternatives that are possible for such a comprehensive system of formal ontology. That is, there may be different comprehensive systems of formal ontology in the same sense in which there can be different comprehensive metaphysical theories, even though each formal ontology views itself internally as the final arbiter of all logical and ontological distinctions. The study of different possible formal ontologies, their consistency, adequacy, and relative strength with respect to one another, and, similarly, the study of the alternative theories that may be realized in the different branches of a comprehensive formal ontology, may together be called *comparative formal ontology*.

An important distinction between different comprehensive systems of formal ontology is whether *being* is taken in such a system as univocal or multivalent. It is multi-

valent, for example, when different types or categories of expressions are understood as representing different modes or categories of being, in which case there will also be different types of variables bound by quantifiers having the entities of those different categories as their values. Where being is univocal, on the other hand, i.e. where there is just one ontological category or mode of being (being *simpliciter*), only one type of quantifiable variable will have semantic significance. In a formal ontology for *nominalism*, for example, there will be no ontological category corresponding to any grammatical category other than that of singular terms, and in particular there will be no ontological category or mode of being corresponding to the grammatical category of predicate expressions. Only individual variables, i.e. the category of variables having singular terms as their substituends, will have semantic significance in such a formal ontology. Predicate variables, and quantifiers binding such, if admitted at all, must then be given only a substitutional, and not a semantical, interpretation, which means that certain constraints must be imposed on the logic of the predicate quantifiers in such a formal ontology. Most nominalists in fact eschew even such a substitutional interpretation of predicate quantifiers and describe their ontology only in terms of first-order logic where there is but one type of bindable variable, i.e. where, as in W. V. O. Quine's phrase, *to be* is *to be the value of a bound individual variable.* It should be noted, however, that, unlike traditional nominalists, some contemporary nominalists (e.g. Quine and Nelson Goodman), take abstract objects (e.g. sets or qualia) as well as concrete individuals to fall under their supposedly univocal sense of being. (Cf. Goodman 1956, p. 17.) This means that although there is but one ontological category or mode of being in such an ontology, there may still be different 'kinds' of being. That is, in such a system being is a genus, which is not at all the same as being multivalent.

Being is also univocal in some forms of realism (regarding universals). This would appear to be the case, for example, in the ultra-realism of certain early scholastic philosophers for whom the realm of being is the realm only of universals (as in the teachings of John Scottus Eriugena and Remigius of Auxerre). It is certainly univocal in the case of certain contemporary forms of *logical realism*, where properties, relations, concrete individuals, and perhaps states of affairs as well, are different kinds, as opposed to modes or categories, of being. A formal ontology for such realists is developed today much as it is in nominalism, viz. as an axiomatic first-order logic with primitive predicates standing for certain basic ontological notions. Indeed, except perhaps for the distinction between an intensional and an extensional logic, there is little to distinguish realists who take being to be univocal from such nominalists as Quine and Goodman who include abstract objects as values of their individual variables and who describe such objects axiomatically (e.g. in terms of a set-theoretic relation of membership, or of a mereological relation of overlap, or of part to whole). This is particularly true of those realists who, in effect, replace the extensional membership relation of an axiomatic set theory by an intensional relation of exemplification, and, dropping the axiom of extensionality, call the result a theory of properties (cf. Bealer 1982). Formal ontology, in other words, for both the nominalist and that kind of realist who takes being to be univocal and who has abstract as well as concrete objects as values of his individual variables, i.e. for whom being is a genus, is really no different from an applied theory of first-order logic in which the primitive 'non-logical' (or descriptive) constants and axioms are taken as describing certain basic ontological notions. In such a framework, it would seem, the dividing line between the logical and the non-logical, or between pure formal ontology and its applications, has become somewhat blurred, if not entirely arbitrary.

Beginning with Aristotle, the standard assumption in (pre-formal) ontology has been that being is not a genus, i.e. that being is multivalent, and that the principal method of ontology is categorial analysis. This raises the problem of how the different categories or modes of being fit together, and of whether one of the senses or modes of being is pre-

eminent and the others somehow dependent on that sense or mode of being. The differential categorial analyses that have been proposed as a resolution of this problem have all turned in one way or another on a theory of predication, i.e. on how the different categories fit together in the nexus of predication, and they have differed from one another primarily on whether the analysis of the fundamental forms of predication is to be directed upon the structure of reality or the structure of thought. In formal ontology, the resolution of this problem involves the construction of a formal theory of predication.

Aristotle's categorial analysis, for example, is directed upon the structure of reality and not upon the structure of thought, and the pre-eminent mode of being is that of concrete individual things (or primary substances). Predication, moreover, is explained in terms of two ontological configurations that together characterize the essence-accident distinction of Aristotle's ontology, viz. the relation between an individual and its species or genera on the one hand, and the inherence of a universal in an individual on the other. Aristotle's *moderate realism* regarding species, genera, and universals is a form of *natural realism* and not of logical realism, and a formal theory of predication constructed as an Aristotelian formal ontology must respect that distinction as well as give an adequate representation of the two ontological configurations underlying the Aristotelian analysis of predication. In particular, such a theory must contain a logic of natural kinds and must impose the constraint of moderate realism that every natural property or relation is instantiated (i.e. that every natural property or relation exists only *in rebus*). This constraint leads to Aristotle's problem of the fixity of species (according to which members of a species cannot come to be except from earlier members of that species, and that therefore there can be no evolution of new species); but, given the modal category of natural necessity and possibility as part of a revised Aristotelian formal ontology of *modal natural realism*, this problem can be resolved by requiring of every natural property or relation not that it actually be instantiated (at any given time) but only that such an instantiation be within the realm of natural possibility. Such a formal ontology, needless to say, will contain a modal logic for natural necessity and possibility, as well as a logic of natural kinds that is to be described in terms of that modal logic. (Cf. Cocchiarella 1976.)

Plato's ontology is also directed upon the structure of reality, but the pre-eminent mode of being in this framework is not that of concrete or sensible objects but of the Ideas. This leads to the problem of μέθεξις, or of how and in what sense concrete objects participate in Ideas, and also to the problem of χορισμός, or of how and in what sense Ideas are 'things' or abstract individuals separate from the concrete individuals that participate in them. A Platonist theory of predication in contemporary formal ontology is the basis of logical realism (where it is assumed that a property or relation exists corresponding to each well-formed predicate expression of logical grammar, regardless of whether or not it is even logically possible that such a property or relation has an instance). When applied as a foundation for mathematics (as was Plato's own original intent), logical realism is also called *ontological logicism*. The best-known form of logical realism today is Bertrand Russell's theory of logical types, which Russell developed as a way to avoid his famous paradox of predication (upon which his paradox of membership is based), a paradox not unrelated to Plato's problem of χορισμός. Whether and to what extent Russell's theory of logical types can satisfactorily resolve either of Plato's problems and be the basis of an adequate realist formal ontology is an issue that belongs to what we have called comparative formal ontology.

Kant's categorial analysis, unlike Aristotle's, is directed upon the structure of thought rather than upon the structure of reality. The categories function on this account to articulate the local forms of judgements and not as the general causes or grounds of concrete being. There is no pre-eminent mode of being identified in this analysis, accordingly, other than that of the thinking subject, whose synthetic unity of apperception is what unifies the categories

that are the bases of the different possible judgements that can be made. What categories there are and how they fit together to determine the concept of an object in general is determined through a 'transcendental deduction' from Kant's table of judgements, i.e. from the different possible forms that judgements might have according to Kant. It is for this reason that the logic determined by this kind of categorial analysis is called *transcendental logic*.

The transcendental logic of the later Husserl is perhaps one of the best-known versions of this type of approach to formal ontology. According to Husserl, logic, as formal ontology, is a universal theory of science, and as such it is the justifying discipline for science. But even logic itself must be justified, Husserl insists, and it is that justification that is the task of transcendental logic. This means that the grounds of the categorial structures that determine the logical forms of pure logic are to be found in a transcendental subjectivity, and it is to a transcendental criticism of such grounds that Husserl turns in his later philosophical work. On the basis of such a criticism, for example, Husserl gives subjective versions of the laws and rules of logic, such as the law of contradiction, the principle of excluded middle, and the rules of *modus ponens* and *modus tollens*, claiming that it is only in such subjective versions that there can be found the *a priori* structures of the evidence for the objective versions of those laws and rules (cf. *Formal and Transcendental Logic*, §§75–8). Husserl also claims on the basis of such grounds, however, that every judgement can be decided (ibid., §§79–80), and that a 'multiplicity', such as the system of natural numbers, is to be "defined, *not by just any formal axiom-system*, but by a 'complete' one" (ibid., §31, p. 96). That is,

> the axiom-system formally defining such a multiplicity is distinguished by the circumstance that any proposition . . . that can be constructed, in accordance with the grammar of pure logic, out of the concepts . . . occurring in that system, is either 'true' – that is to say: an analytic (purely deducible) consequence of the axioms – or 'false' – that is to say: an analytic contradiction –; *tertium non datur* (ibid.; cf. also *Ideas*, §72, pp. 187f.).

Unfortunately, while such claims for transcendental logic are admirable ideals, they are nevertheless in conflict with certain well-known results of mathematical logic.

The transcendental approach to categorial analysis, as this last observation indicates, raises the important problem of the completeness of formal ontology. It does this, moreover, not in just one but in at least two ways: first, as the problem of the completeness of the categories; and, second, as the problem of the completeness of the laws of consequence regarding the logical forms generated by those categories. For Aristotle, for whom the categories are the most general 'causes' or grounds of concrete being, and for whom categorial analysis is directed upon the structure of reality, the categories and their systematization must be discovered by an inductive abstraction and reflection on the structure of reality as it is revealed in the development of scientific knowledge, and therefore the question of the completeness of the categories and of their systematization can never be settled as a matter of *a priori* knowledge. For Kant and the transcendental approach, however, the categories and the principles that flow from them have an *a priori* validity that is grounded in the understanding and pure reason respectively – or, as on Husserl's approach, in a transcendental phenomenology – and the question of the 'unconditioned completeness' of both is said to be not only practical but also necessary. The difficulty with this position for Kant is that neither the system of categories nor the laws of logic described in terms of those categories can be viewed as providing an adequate system of formal ontology as we have described it above. Kant's description of logic, for example, restricts it to the valid forms of the syllogism (which can in no sense account for the complexity of many intuitively valid arguments of natural language, not to mention the complexity of proofs in mathematics). Husserl, unlike Kant, does not himself attempt to settle the matter of a complete system of categories, nor therefore of a complete system of the laws of logic or formal ontology; but he does maintain that such completeness is not only possible but necessary, and that the results achieved re-

garding the categories and their systematization must ultimately be grounded on the *a priori* structures of the evidence of a transcendental subjectivity. The transcendental approach in general, in other words, or at least the *a priori* nature of its methodology as originally described, leaves no room for inductive methods or new developments in either logic or categorial analysis, especially in the way both are affected by new results in scientific theory (e.g. the logic of quantum mechanics and the way that that logic relates to the logic of macrophysical objects), or in theoretical linguistics (e.g. universal grammar and the way that that grammar is related to the pure logical grammar of a formal ontology), or even in cognitive science (e.g. artificial intelligence and the way that the computational theory of mind is related to the categorial and deductive structure of logic).

The difficulties of the *a priori* methodology of the transcendental approach with the problem of completeness do not mean that we must give up the view that an analysis of the forms of predication is to be directed primarily upon the structure of thought, and only secondarily, through our cognitive acts, upon the structure of reality. There are other alternatives that such a view might adopt besides the transcendental idealism of either Kant or Husserl. Jean Piaget's genetic epistemology with its 'functional' (as opposed to absolute) *a priori*, for example, is such an alternative, and so is Konrad Lorenz's biological form of Kantianism with its evolutionarily determined (and therefore non-transcendental) *a priori*. Any version of a naturalized epistemology, in other words, where an *a posteriori* element would be allowed a role in the construction of a formal ontology, might serve as such an alternative. The comparison of these alternatives, and a study of their adequacy (as well as of the adequacy of a more complete and perhaps modified account of transcendental apriority) as epistemological grounds for a categorial analysis that is directed upon the structure of thought, are issues that properly belong to comparative formal ontology.

It is perhaps important to note in this context that different research programmes can always be carried out in restricted branches or sub-domains of formal ontology, without first deciding whether or not the categorial analysis of the global framework within which such a branch or sub-domain is to be fitted is to be directed upon the structure of thought or the structure of reality. Similarly, we do not always have to decide in advance whether or not there must (or even ever can) be a final completeness to the categories or of the laws of logic before undertaking such a research programme. We can always strive, in other words, to establish restricted or relative notions of completeness for special areas of formal ontology relative to certain research programmes, and we can then compare and evaluate those results in the context of comparative formal ontology. The methodology of mathematical logic in the sense of the construction of abstract formal systems, together with a set-theoretical semantics for those systems, will be especially useful in this regard.

We must be cautious in our use of this methodology, however, and especially in how we apply such well-known mathematical results as Kurt Gödel's incompleteness theorems. Gödel's first incompleteness theorem, for example, does not show, as is commonly claimed, that any formal theory of predication encompassing standard second-order logic must be incomplete. Rather, it only shows that this must be so with respect to the standard set-theoretic semantics for second-order logic. What must not be confused and wrongly identified in this regard is the logical concept of a class (as the extension of a concept) with the mathematical concept of a set (in the sense of the iterative concept, which is based on Georg Cantor's theorem that the set of all subsets of any given set always has a greater cardinality than that set). This distinction is of fundamental importance to ontology; for whereas classes have their being in the concepts whose extensions they are and not in their members, sets are essentially composed of (and in that sense have their being in) their members and need not correspond to the extension of any concept (such as, e.g., the sets determined by the axiom of choice). Cantor's theorem, for example, while essential to the iterative con-

cept of set, will in fact fail in certain special cases of the logical concept of a class (such as, e.g., the universal class). For this reason a representation of concepts by sets in a set-theoretical semantics will not always result in the same logical structure as a representation of those concepts by the classes that are their extensions, and an incompleteness theorem based on the one kind of structure need not imply an incompleteness theorem based on the other.

A set-theoretical semantics for a formal theory of predication must not be confused, in other words, with a semantics for that theory based on its own forms of predication taken primitively. For the latter, being based on the very forms of predication that it is designed to interpret, is in that sense an internal semantics for that theory, while the set-theoretical semantics, being based on the membership relation of a framework not internal to the theory itself, is an external semantics for that theory. This means that in constructing a set-theoretical semantics for a formal theory of predication we must be cautious not to confuse and literally identify the internal content or mode of significance of the forms of predication of that theory with the external model-theoretic content of the membership relation, or (as in the case of a set-theoretic possible worlds semantics) with the external content of any function (e.g. on models as set-theoretic representatives of possible worlds) defined in terms of the semantically external membership relation. If we do not confuse predication with membership in this way, then we will be able to see why the incompleteness of second-order logic with respect to its standard set-theoretical semantics need not automatically apply to any formal ontology designed to include standard second-order logic as part of its formal theory of predication. The careful separation and clarification of these issues is a topic that belongs to the methodology of comparative formal ontology.

Gödel's first incompleteness theorem does show that any formal ontology that includes arithmetic (as part of its pure formal content) must be deductively incomplete; that is, not every well-formed sentence of the pure logical grammar of such a formal ontology will be such that either it or its negation is provable in that formal ontology. This does impose a limitation on what can be deductively achieved in such a formal ontology, and it requires a modification, if not a complete revision, of any categorial analysis (such as Husserl's) where the ideal of deductive completeness (at least for an infinite 'multiplicity', such as the system of natural numbers, that is taken as an essential part of pure formal ontology) is a necessary feature of that analysis. Deductive incompleteness does not imply semantic incompleteness, however, and the real significance of Gödel's incompleteness theorem for formal ontology, aside from the limitation it implies on what can be deductively achieved in such a system, is how to characterize this difference internally. That is, what must be resolved in a formal ontology that is to contain arithmetic as part of its pure formal content is the problem of how the completeness of its internal content is to be distinguished from its deductive incompleteness, and how within that pure formal content we are to characterize the content of arithmetic (and perhaps, more generally, all of classical mathematics as well). Finally, in regard to Gödel's second incompleteness theorem, what must also be resolved for such a formal ontology is the question of how, and with what sort of significance or content, we are to prove its consistency, since such a proof is not available within that formal ontology itself. Again, these are issues that are to be investigated not so much in a particular formal ontology as in comparative formal ontology.

Comparative formal ontology, as our remarks have indicated throughout, is the proper domain of many issues and disputes in metaphysics, epistemology, and the methodology of the deductive sciences. Just as the construction of a particular formal ontology lends clarity and precision to our informal categorial analyses and serves as a guide to our intuitions, so too comparative formal ontology can be developed so as to provide clear and precise criteria by which to judge the adequacy of a particular system of formal ontology and by which we might be guided in our comparison and evaluation of different proposals for such systems. It is only by

constructing and comparing different formal ontologies that we can make a rational decision about which such system we should ourselves ultimately adopt, and that is a decision that can be made only in comparative formal ontology.

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Ontology III: Regional Ontology

According to Edmund Husserl, the world of objects is ordered in a way that every individual thing can be exhaustively determined through a finite number of concepts. This leads to highest material concepts, the 'regional' essences under which all objects stand. These essences in turn are comprehended under the widest and purely formal concept of the object or something in general.

The system of truths deriving from the formal, empty notion of object as such and from its modifications, is formal ontology or the pure theory of objects. As a *mathesis universalis* it comprises apophantic logic, i.e. the formal theory of meanings pertaining to propositions as such, and the formal subtheories of objects as the correlates of propositions, such as the pure theory of numbers and manifolds (sets). To the categories that make up the totality of formal ontology belong such concepts as relation, connection, series, identity, equality, genus, species, whole, part, number, magnitude, state of affairs, and property. All truths of formal ontology are *a priori*; they are analytically derivable from the formal essence of the object as such.

The formal region furnishes the form of all material regions. Therefore the laws of logic are valid in all regions whatsoever. Consequently all regions of objects are accessible to reason and to rational cognition. A first material concretization or 'filling' of formal ontology is reached in formal axiology, the theory of ethical and aesthetic value that is the counterpart of feeling, and in formal praxeology, the theory of oughts and demands which are the correlates of willing. Here the formal notion of the object as such is restricted, respectively, to the value as such and to the ought as such. In this sense, formal axiology and praxeology are material subdisciplines of formal ontology. As opposed to the material theory of the various sorts of values and of concrete demands, they are, however, purely formal disciplines parallel to formal ontology. The latter, then, deals above all with the object of cognition as such and becomes the general ontology of possible worlds as such.

The basic material ontology within this formal framework is the regional ontology of reality in the sense of nature. It deals with synthetic truths *a priori*, i.e. the axioms that relate to the material things of the natural world. It thus contains the pure doctrines of space (geometry), time (chronology), and movement (phoronomy), as well as the study of the concept of matter (including extension, substantiality, and causality).

As founded upon this ontology, Husserl mentions the regions of the animate (the living body) and more specifically of the human body. More important is, however, the region delimited by the concept of the 'soul', i.e. of psychic life. The body of essential truths related to it constitutes a psychology which, in contrast to empirical psychology, is called by Husserl rational, eidetic, or phenomenological. This ontology of mind (as it is also called) deals with experiences in the sense of describing the essences of perception, remembering, ima-

gination, expectation, thinking, feeling, willing, and the like.

A third major ontology founded upon the two previous ones – and therefore dealing with an object of higher order – is social ontology based on the various complications and modalities of intersubjectivity. The *a priori* study of such cultural formations as state, law, literature, and so on form a part thereof.

Whereas Husserl worked out large portions of formal ontology as well as of the ontologies of nature and mind, his treatment of the ontology of society consists for the most part of projects and sketches. Moreover, it is not clear whether for him the three major regional ontologies do indeed exhaust the field of possible material regions.

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Order Relations

When reading the literature on mathematical order relations one notices, first, that the terminological situation is chaotic and, second, that there are different ways of building up the relevant concepts. The following is oriented around the approach used by P. Hinst (lectures, Munich, 1986–7). The underlying terminology is presented in the article "Relation" elsewhere in this Handbook. To illustrate the concepts developed below we shall employ:

ID: the identity relation

$\subset$ and $\subseteq$: the proper and improper subset relation

$<$ and $\leqslant$: the relations strictly-less-than and less-than-or-equal-to defined on the natural numbers

$\sim$, $\prec$, and $\preceq$: the relations of cardinal-equivalence and of strictly-less-than and less-than-or-equal-to in respect of power

AH, H, and HAH: the relations equally-heavy, heavier-than and heavier-than-or-equally-heavy defined for medium-sized bodies.

'Class' and 'set' are employed synonymously in what follows.

Equivalence Relations. A relation which is both transitive and symmetrical is called an equivalence relation. Because reflexivity and left- (or right-) comparability are necessary and sufficient for symmetry and transitivity, it follows that equivalence relations can also be characterized as reflexive and left- (or right-) comparative relations. G is an equivalence relation on U if the field of G coincides with U. A set Z is G-invariant if xGy and $x \in$Z imply $y \in$Z. Finitude and infinitude for example are $\sim$-invariant. The *principium äqualitatis indiscernibilium* can be formulated in terms of invariance: items stand in an equivalence relation iff they are indistinguishable in regard to the properties which are invariant relative to this equivalence relation. More precisely: if x is taken from the field of G, then there holds: if G is an equality relation, then xGy iff for all G-invariant properties Z, $x \in$Z iff $y \in$Z. Since every item belongs to the field of ID, and since ID is an equivalence relation, it follows that the *principium identitatis indiscernibilium* (i.e. xIDy iff for all Z, $x \in$Z iff $y \in$Z) is a special case of the above principle. If, on the other hand, x,y stand in a relation G iff they are indistinguishable in regard to the G-invariant properties, then G is an equivalence relation.

Z is an equivalence class determined by G (a G-equivalence class) iff $Z \neq \emptyset$, Z is G-invariant, and $x,y \in$Z implies xGy. It follows that if G is an equivalence relation then there obtains:

1. xGy iff there is some G-equivalence class Z for which $x,y \in$Z.
2. Different G-equivalence classes are disjoint.
3. Every *term* of G is an element of exactly one G-equivalence class.
4. The field of G is the union of the class of all G-equivalence classes.
5. The G-image of the unit set of x, which is to say $\{u|u\text{G}x\}$, is a G-equivalence

class. Hence for example $\{u|u\sim x\}$ is a $\sim$-equivalence class. If one now defines the functor 'the cardinal number of' by means of:

the cardinal number of $x = \{u|u\sim x\}$,

then this is an example of what is traditionally called a '(classical) definition by abstraction'.

U is a *partition* of Z iff $\emptyset$ is not an element of U, the intersection of distinct U-elements is empty (disjointness) and the union of U coincides with Z (exhaustiveness). The set generated by G is the class of all G-equivalence classes. The relation documented in U is the class of all ordered pairs $x\,y$ for which there exists an element A of U with $x,y\in A$. If G is an equivalence relation on Z, then the set generated by G is the partition of Z. If, on the other hand, U is a partition of Z, then the relation documented in U is an equivalence relation on Z. Every equivalence relation on a set thus generates exactly one partition and in every partition of a set there is documented exactly one relation. If U is a partition of Z and G an equivalence relation on Z, then the relation documented in U is identical with G iff the set generated by G coincides with U. The set generated by AH is a disjoint and exhaustive division of the class of bodies in sets of bodies having equal mass, and AH is the relation which is documented in this partition. If U is a partition of Z, then P is a *system of representatives* of U iff for each U-element W there is exactly one x in P which is an element of W.

Partial and Total Orderings. A relation R is a *partial order relation* iff R is antisymmetric and transitive. A *total order relation* is in addition connected. A partial order which is field restricted is itself a partial order; total order which is field restricted is itself a total order. Reflexivity and irreflexivity contribute nothing to the order character of a relation, yet it is reflexive and irreflexive orderings which are the principal objects of investigation. $\subseteq$ and $\leqslant$ are partial reflexive orderings, $\leqslant$ is in addition total. $\subset$, $<$, $\prec$, and H are partial irreflexive orderings, $\prec$ is in addition total. The *irreflexive counterpart* of R is the class of all ordered pairs $[x,y]$ for which $x\mathrm{R}y$ and $x\neq y$. Thus the irreflexive counterparts of $\subseteq$ and $\leqslant$ are $\subset$ and $<$. The *reflexive counterpart* of R is the class of all ordered pairs $[x,y]$ for which $x\mathrm{R}y$ or ($x = y$ and x and y are in the field of R). In the case of a partial reflexive ordering R, the field of the irreflexive counterpart is a subset of the field of R. In the case of a total reflexive ordering the two fields are identical in case the relation R has at least two terms.

x is an R-*predecessor* of y iff $x\mathrm{R}y$ and $x\neq y$. If there is no z distinct from both x and y and such that $x\mathrm{R}z$ and $z\mathrm{R}y$ then x is the *immediate* R-*predecessor* of y. Definitions of *successor* and of *immediate successor* can be constructed accordingly. The *predecessor class* of y relative to R is the class of all R-predecessors of y. U is a (*proper*) *segment* of R if the R-image of U is a subset of U and U is a (proper) subset of the field of R. 2 and 3 are $<$-predecessors of 4; 3 is in addition the immediate predecessor. The predecessor class of 4 relative to $<$ is $\{0,1,2,3\}$, which is itself a proper segment of $<$. It holds quite generally for terms x of a partial ordering R that the predecessor class of x relative to R is a proper segment of R. For partial orderings we have in addition that if $y\mathrm{R}x$, then the predecessor class of y relative to R is a subset of the predecessor class of x relative to R. If $x\mathrm{R}y$ and y is an element of the predecessor class of z relative to R, then x, too, is an element of this class. If x and y are terms of a connected relation whose R-predecessor classes are identical, then we have $x = y$.

Quasi-series. R forms a quasi-series with G iff G is an equivalence relation and R is a transitive, G-antisymmetric, G-connected and G-extensional relation whose field is identical with that of G. Both H and HAH form a quasi-series with AH. Thus H is AH-connected (for all bodies x,y, either $x\mathrm{H}y$ or $x\mathrm{AH}y$ or $y\mathrm{H}x$); and it is AH-extensional (for all bodies x,y,u,w, if $x\mathrm{AH}u$, $y\mathrm{AH}w$ and $x\mathrm{H}w$, then $u\mathrm{H}w$). R is a total order iff R forms a quasi-series with ID restricted to the field of R. The concept of quasi-series is in this sense a generalization of the concept of total order. If R forms a quasi-series with G, then the result of subtracting G from R is an irreflexive partial ordering.

If one turns from the terms of R or of G to the equivalence classes determined by G,

then one notices that these form a total ordering. We define the *ordering induced* by R and G as the class of all ordered pairs [X,Y] of equivalence classes of G for which there exist u, w with $u \epsilon X$, $w \epsilon Y$ and uRw. If R forms a quasi-series with G, then the ordering induced by R and G is a total ordering whose field is the set generated by G.

Distinguished Elements. x is a *lower bound* of U relative to R iff R is a relation, x an element, and U a subset of the field of R, and x stands in R to all other U-elements. (The definition of *upper bound* follows accordingly.) Lower bounds of {4,8,20} relative to $\leqslant$ are for example 0, 1, 2, 3, 4; upper bounds are for example 20, 21, 100, 1012. 4 is not however a lower bound of {4,8,20} relative to $<$. A lower bound for U relative to R to which all other lower bounds stand in R is called an *infimum* or greatest lower bound of R. (The definition of *supremum* or least upper bound follows accordingly.) 20 is then a least upper bound of {4,8,20} relative to $\leqslant$. Since all antisymmetric relations R possess at most one infimum and supremum for any given U relative to R, we can define: if R is antisymmetric and if there exists an infimum of A relative to R, then *the infimum* of A relative to R = u iff u is an infimum of A relative to R. Clearly an exactly similar definition can be supplied for *the supremum*.

If a lower bound x of U relative to R is also an element of U, then x is a *first element* of U relative to R (and similarly for *last element* of U). 4 and 20 are the first and last elements of {4,8,20} relative to $\leqslant$. The given set contains no first and last elements relative to $<$. A first element is in every case an infimum, a last element in every case a supremum. As the last example shows, however, the converse does not obtain. If R is antisymmetric and if U possesses a first element relative to R, then one can speak of *the* first (and similarly of *the* last) element of U relative to R. If R is antisymmetric and if there is a lower bound of the field of R relative to R, then the R-first element of the field of R possesses no R-predecessor (and similarly for the last element). If R is total ordering we have:

1. If U is a segment of R and x is the R-first element of the field of $R \backslash U$ (which is to say of the field of what is left of R after U has been subtracted), the U is identical with the class of R-predecessors of x.
2. If z is a term of the relation R, then z is identical to the R-first element of the field of R reduced by the class of R-predecessors of z.

x is a *minimal element* in U relative to R iff R is a relation, U is a subset of the field of R, x is an element of U, and no U-element y distinct from x stands in R to x. (The definition of *maximal element* follows accordingly.) Minimal elements of U relative to R possess no R-predecessors in U, maximal elements no R-successors in U. If R is antisymmetric then first elements of U relative to R are always minimal elements, last elements always maximal. If R is connected then minimal elements of U relative to R are always first elements, maximal elements always last. Thus if R is connected and antisymmetric, then x is a first element of U relative to R iff it is a minimal element of U, and x is a last element iff it is maximal.

Well-ordering. A set R is called *founded* if every non-empty subset U of the field of R possesses an R-minimal element z. If R is antisymmetric and connected then z will be the R-first element in U. Founded sets are antisymmetric, sets which are both founded and connected are transitive. The *theorem of general value-range induction*, which yields the basis for a whole family of methods of proof and definition, reads:

> For all R and U, if R is founded, then we have: if, given x in the field of R and given that the class of predecessors of x relative to R is a subset of U, it follows that x is in U, then the field of R is a subset of U.

In order to prove that some given U* includes as subset the field of some founded relation R, it is sufficient to prove the induction step: if x is an element of the field of R and the class of predecessors of x relative to R is a subset of U*, then x is a member of U*. The given theorem allows one to prove a principle of definition, the *general recursion-theorem*.

This will allow us to characterize functions f by identifying their domain with the field of a well-ordering R and by fixing the value of f for a given term x of R by reference to all values of f for the predecessors of x.

Total orderings which are in addition founded are called *well-orderings*. Since foundedness guarantees antisymmetry, and foundedness with connectedness guarantees transitivity, well-orderings can also be characterized as connected and founded relations. $<$ is an irreflexive, $\leq$ a reflexive well-ordering. For non-maximal terms x of a well-ordering R one can speak of *the* R-successor of x in the sense of the *immediate* R-successor. The field-restriction of a well-ordering R to a given U is once again a well-ordering. If U is a subset of the field of R with at least two elements, then U is identical with the field of R field-restricted to U.

In order to compare well-orderings we define: R is *isomorphic* to S iff there is a bijection f from the field of R to the field of S, for which for R-terms x,y xRy iff the ordered pair of $f(x)$ and $f(y)$ is an element of S. The class IS of all ordered pairs [R,S] for which R is isomorphic to S is an equivalence relation. No well-ordering is isomorphic with a proper segment. Moreover there obtains the following law: two well-orderings R and S, either both reflexive or both irreflexive, are isomorphic or they are such that one is isomorphic to a proper segment of the other.

Significance. Orderings are important from the philosophical point of view for at least the following reasons. First, they constitute, along with algebraic and topological structures, a type of structure from whose development and combination the edifice of mathematics results. Second, the theory of (well-)orderings yields the foundation for the processes of induction and recursion which are important from the point of view both of concept-formation and of proof. Third, the antinomy of Burali-Forti, to the effect that the class of all ordinal classes both is and is not an element of itself, falls into the scope of order theory. Finally, there is an equivalence between the axiom of choice (to the effect that every partition has a system of representatives) – perhaps the most controversial principle of set theory – and some important order-theoretical principles like Cantor's well-ordering theorem and Zorn's Lemma.

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Oresme. See: Nicole Oresme

Origen

Origen is a Platonist philosopher, the greatest and most controversial figure in the so-called Alexandrian School of Christian thinkers founded by Pantaenus (*c.* 180–200), and continued by Clement (*c.* 150–*c.* 215) – and after Origen, by Didymus the Blind. He was born in *c.* 185 AD, of good family, his father being a convert to Christianity of some prominence in the local administration. In 201–2, when Origen was about 17, his father was arrested by the prefect, Laetus, refused to recant his faith (exhorted to firmness by the young Origen himself), and was executed. Origen was obliged to support the family as a school teacher. Demetrius, the bishop of Alexandria, actually entrusted him with the headship of the catechetical school, where he taught initially γραμματική, that is, profane letters. At the same time, he seems to have attended the lectures of the charismatic Platonist teacher, Ammonius Saccas (*c.* 160–242) (discovered some decades later by Plotinus). If he did this, it was not as an uncritical disciple, but rather with the aim of acquiring a Platonist background for the Christian philosophical synthesis which he was in the process of developing. Whether,

on the other hand, he was ever a pupil of Clement is uncertain, despite Eusebius's assumption that he was. It is notable that he never mentions Clement in any surviving work.

Origen was a natural teacher, and became very popular, but after some time (probably about 211, following a period of persecution under the prefect Aquila) he experienced a conversion, sold his books, renounced profane learning, and imposed upon himself a strictly ascetic regime. It was at this stage of his life, still perhaps in his late teens, that he seems to have decided to castrate himself, taking the injunction of Matthew 19:12 too literally. There seems no reason to disbelieve this story. The action seems entirely in keeping with the sort of highly intelligent, but intense, youth he then was. It is in these years that he will have composed his first exegetical work, characteristically a commentary on that torrid poem of divine love, the Song of Songs, of which he later gave a more extensive exegesis.

In about 215 he made a journey to Rome, where he found the church in the throes of a controversy about Sabellius's "Monarchianism", which may have negatively influenced his own theology in the direction of making a strong distinction between God the Father and Christ. He was back in Alexandria by 217, and continued his teaching of religious philosophy. At this time, he acquired a Hebrew teacher, and began to take a lively interest in the text of the Old Testament, an interest which was to issue in the mighty enterprise of the *Hexapla*, an edition of the Old Testament arranged in six columns, beginning with a Hebrew text.

At this stage in his career, he attracted an important disciple in the person of Ambrosius, a rich man who had been a Valentinian Gnostic, but whom Origen converted to orthodoxy. Ambrosius urged him to write, and even engaged short-hand writers to take down dictation from him. It is to Ambrosius, in fact, that we owe the existence of much of Origen's oeuvre, particularly the thirty-two books of the *Commentary on John* and the *Contra Celsum*, which Ambrosius commissioned.

By 229, tensions appear to have arisen between Origen and Bishop Demetrius, both personal and doctrinal. By this time Origen would have produced his most important theoretical work, the *De Principiis*, which presents a remarkable philosophical system in which Christ, as the *Logos*, becomes the focal point of a great cycle of creation, which leads ultimately to the restoration of all elements of the cosmos in Christ in a way that offended simple-minded notions of eternal punishment and of the uniqueness of the human soul. Even the devil, it seemed, would ultimately be saved, and we must pass through many cycles of incarnation before being thoroughly purged. The bulk of the work only survives in a much-modified Latin version by Rufinus, but some key extracts of the original give us a notion of the true picture.

Origen set off on a visit to Palestine, where he was warmly received in Caesarea by Theoctistus, and in Jerusalem by Alexander, and invited to preach in their churches. Relations with Demetrius deteriorated on Origen's return to Alexandria, and he left once again. In 232, Theoctistus ordained him priest. Demetrius was enraged, and complained against him to Rome. After a visit to Athens, where he had to defend himself, Origen settled in 234 in Caesarea, which continued to be his home for the rest of his life. Here he opened a school which became widely famous, and wrote the bulk of his vast works. He commented, during the next fifteen years or so, in the form either of full-scale commentaries or of homilies, on most of the Old and New Testaments, culminating in the *Contra Celsum*, a learned defence of Christianity against a comprehensive attack on it by a 2nd-century Platonist, and the commentaries on Matthew and Luke, around 248–9. At some time not long after 251 he was arrested, in the persecution of Decius, and died as a result of tortures inflicted in prison.

Origen was the greatest intellect among the early Church Fathers. He never wished to be other than orthodox, but his bold attempt to create a Christian philosophy on the basis of the Scriptures involved him in continuous controversies throughout his life. He was not, however, comprehensively condemned until long after his death, mainly due to the excess

of certain followers of his in the 4th century. Even when his doctrines were condemned, however, his allegorical method of exegesis remained enormously influential in both East and West, through Jerome and Ambrose on the one hand, and the Cappadocian Fathers on the other.

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JOHN M. DILLON

P

Panaitios

Panaitios was born between 185 and 180 BC in Lindos (Rhodes). After devoting himself to grammatical and philosophical studies, he followed the Stoic Diogenes of Seleucia and was also part of the Stoa under the scholar Antipater of Tarsos. After the death of the latter (129) he became head of the Stoic School until he died around 110. No writings of Panaitios have been preserved. We know of his work on duty through the revision made by Cicero (106–43 BC) in *De officiis* and of his other books through quotations.

In his philological studies and in his studies in the history of philosophy, Panaitios defined the historical position of the Stoa as a Socratic school. This allowed him to call upon the great classical philosophers to revise critically and to interpret newly the Stoic philosophy. In epistemology he adheres to Stoic sensualism but lays special emphasis on the verification which reason must perform if it is to ascend to a perception.

In physics he follows the ideas of Zeno of Citium. He regards the world as a self-regulating physical system, neglecting, however, the vitalistic and pantheistic aspect of Stoic philosophy. This leads to critical reservations towards the usual Stoic notion of a periodical recurrence of creation and destruction of the world and towards the radical determinism which results therefrom.

In ethics Panaitios widened the anthropological basis by newly interpreting the theory that men have a sense of 'affection' or 'endearment' for themselves (οἰκείωσις). Four different sorts of striving are distinguished in the soul (which is understood also as reason): the striving for self-preservation and preservation of the species; the striving for knowledge; the striving to take priority over men and things; and the striving after order and measure (with which the sense of beauty is associated). In his metaphorical way he states that man has four 'masks' or *personae*. Two of these are given by nature: these are the universal nature of man as man and his particular individual disposition. The third mask is given by chance: it is made up of the internal and external circumstances into which man is born and the changes with which he is confronted. The fourth mask is what results when man himself reacts on the ground of his general and individual nature to these outward circumstances. Consequently, it is the goal of man to develop and to improve his own individual nature within the scope of rules deduced from his general nature in dealing with the outward circumstances. Panaitios hereby introduced an individualistic element into his ethics.

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PETER STEINMETZ

Panpsychism

Panpsychism of one sort or another has been favoured by such various thinkers as Spinoza, Leibniz, G. T. Fechner (1801–1887), Charles Renouvier (1815–1903), Rudolf Hermann Lotze, Charles S. Peirce, Ernst Haeckel (1834–1919), William James, W. K. Clifford (1845–79), Friedrich Paulsen (1846–1908), Josiah Royce, A. N. Whitehead, C. Hartshorne, and C. H. Waddington (1907–75). In its clearest forms it claims that physical nature is a multiplicity of entities which are individually sentient, even if most of them only enjoy some dim form of feeling which some think it might be misleading to call 'consciousness'. Non-sentient things are not denied but must be either

a. aggregates of sentient things, or
b. parts of sentient things, or
c. aggregates of units covered by a. and b.

Thus nature is articulated into individually sentient units.

Panpsychism has been developed and defended in two forms.

1. The first sees no special problem in what it is for an item to be physical, but does think it a problem to see how sentience, such as human consciousness, can have arisen from a physical world containing nothing of the sort. Thence it is inferred that the ultimate units of matter have always had a kind of charge of sentience of a lowly kind, and that when they came together in certain ways their sentiences combined to make a fuller sentience. These units of fuller sentience may themselves combine to form a fuller sentience yet and so forth at higher and higher levels. Such a view has appealed especially since the establishment of evolutionary theory. For it explains how the development of higher forms of consciousness has occurred *pari passu* with the development of more complex forms of life and raises no special problem.

The first form of panpsychism has two versions. (1a) On the first it is supposed that simpler sentient states can combine to form more complex ones which are literally made up of them. This is doubtfully coherent, and was effectively criticized by William James as the 'mind dust' theory. The objection is that the parts of a sentient state cannot be sentient states in the same sense. Three separate sentient states each of which experiences one of *A*, *B*, and *C* cannot be a sentient state experiencing the complex or series *A*, *B*, *C*; at most such a state might somehow emerge from them as a fourth state not literally including them. And even if one sentient state could include another (as perhaps a divine sentience includes ours), our sentient states certainly do not seem to include sentient states with their own individual feeling of their own being. (1b) The second more plausible version of this sort of panpsychism would acknowledge this, and only claim that the emergence of a higher sentient state out of lower ones, even though it does not literally include them, is more intelligible than their emergence out of sheer matter. But this sort of panpsychism, thus argued for, remains only a suggestive hypothesis.

2. Much more forceful, if their argument is accepted, is the panpsychism of those who maintain that the essence of the physical is intrinsically mysterious to us. All we really know about physical things are the experiences they give us and some abstract structural facts about them; no satisfactory purely physical conception of the inherent character of what gives this experience and has this structure is coherent. (This may be argued on traditional idealist lines.) Panpsychism then comes as the proposal that the only possible alternative to regarding this inherent character as an unknowable thing in itself is the hypothesis (preferable to agnosticism for a variety of reasons) that it is psychical, i.e. has a nature analogous to our own flow of consciousness. Such a panpsychism could take the unsatisfactory mind dust form, but a better version of it will see non-living matter as made up of units the inner essence of each of which is a state of sentience, and will hold that in certain combinations these produce higher psychic states. However, it will not see that higher psychic state as in the same sense the inner essence of that complex, but as a further unit which functions as the consciousness of it as a whole. The same thing may occur at higher and higher levels, of which the

most obvious example is the issuing of a complete animal's consciousness from the sentience of its brain cells.

Panpsychism may be theistic or atheistic, and may or may not affirm that there is a sentience somehow of nature as a whole.

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TIMOTHY L. S. SPRIGGE

Pantheism

Pantheism is the doctrine that the universe is God. Whilst for orthodox theism of the Judaeo-Christian and also Muslim type, God is a spirit distinct from the universe which he has created, and for the more usual sorts of atheism there is nothing but the natural universe and God is a mere myth, for pantheism the universe itself is divine and is what answers to at least much of what theists think pertains to God. The type of pantheism depends on just what it is about the universe which entitles it to be called God.

The minimum requirement which it would seem that the universe must satisfy to be God is that it must be an appropriate object for emotions of the kind traditionally directed at God. Thus the pantheist must feel, or believe that he ought to feel, love for the universe as a whole, and a joy in being a willing part of its processes, or at least he must feel awe and reverence for it as something the unitary and ultimately harmonious wholeness of which he thinks he somehow senses. Thus pantheism has often been associated with mystical experiences of unity, with nature at large.

There are three main types of pantheism.

1. In its most straightforward form pantheism identifies God with the physical universe conceived in common-sense spatial and temporal terms. This is thought to merit the title of 'God' because it is believed to be a living and conscious organism, our conscious lives being in some manner a part of its life and consciousness. For more metaphysical such pantheists the physical universe may also be thought to earn the title 'God' by being the one eternally and necessarily existing substance, finite things being its contingent and temporary modes or accidents.

2. But some theories are described as pantheistic for which the physical universe is not ultimately real and is only something which minds such as ours must posit for practical purposes. For most such pantheisms the universe is really a single cosmic spirit or mind of which ours are fragments and it is this cosmic spirit which is equated with God.

3. Falling somewhere between these two forms of pantheism are theories for which there is one single divine reality which is either the unified whole of all that there is, or a substance of which all finite things are temporary properties or states, and which can properly be conceived either as an infinite physical entity or as an infinite mind.

In Western philosophy the Stoics have been the main proponents of pantheism of the first type. This system of thought which was founded by Zeno of Citium finds its most vibrant (though not its most orthodox) expression in the *Meditations* of the Emperor Marcus Aurelius (121–80). The second form of pantheism is that of absolute idealists; one of its best exponents was the American metaphysician Josiah Royce. Spinoza's metaphysics is the main statement of the third sort of pantheism.

Not all doctrines describable as pantheism can be safely classified under just one of these heads. Hegel's form of absolute idealism is essentially pantheistic. Ultimately the whole system of things consists in the single reality known as the Absolute Idea actualizing itself in nature and there generating a consciousness in which it can come to grasp its own nature. F. W. J. Schelling (1775–1854) worked through several different forms of partly similar pantheism.

Orthodox Christianity has always been

strongly opposed to pantheism, and when under mystical and metaphysical impulses it has broken out within its bosom has persecuted it as a vile heresy. Thus Giordano Bruno (1548–1600) was burnt at the stake for his pantheistic philosophy. Many poets have tended to pantheism. Thus the nature mysticism of Wordsworth points in this direction, though Wordsworth finally rejected any such position. Shelley was consciously pantheistic in his outlook. The 20th-century American philosophical poet Robinson Jeffers expressed a passionate pantheism in his works.

Hinduism has always had a strong pantheistic tendency, especially in the Vedānta school. Śaṅkara (*c.* 788–820), the most important exponent of Advaita (non-dualist) Vedānta held that truly there was just the one (Brahman), and all else was illusion; Rāmānuja (traditional dates: *c.* 1017–1137), the most important exponent of Viśistādvaita (qualified non-dualism) Vedānta, argued that all finite things are modes of the One but with a certain distinctness of being of their own. Rāmānuja's position is usually thought of as nearer to orthodox Christian theism than Śaṅkara's, in that finite things are given more of an independent reality. However, inasmuch as they are modes of the one divine reality the doctrine is essentially pantheistic, and is structurally very similar to Spinoza's position.

There are some doctrines which come quite close to pantheism, but differ from it in that they do not think of the universe as an appropriate object of worship or love. Arthur Schopenhauer's (1788–1860) view that the world as we know it is the way a single cosmic Will appears to us when it reaches a certain degree of self-consciousness is very pantheistic in spirit, but Schopenhauer expressly held that the Will is too deplorable a thing to be worshipable. Benedetto Croce's (1866–1952) form of idealism sees all that is as the development of the life of a single spirit whose life consists in man's achievements in the sphere of art and thought (forms of contemplation) and of useful and ethical action (forms of practice) but holds that we cannot worship or love this spirit which is ourselves, our task being rather to carry its destinies forward. F. H. Bradley's absolute idealism is virtually a pantheism of the second sort, but he believed that the Absolute (the single spiritual reality which the universe truly is) is too impersonal to be honestly called God, and that the concept of God is practically useful for the religious life but without literal application. Unlike Croce's system, Bradley's gives cognitive content to nature mysticism.

Pantheism has been distinguished (especially by Charles Hartshorne) from panentheism, the doctrine that the universe exists within God (rather than being as for orthodox theism an eject which he has created) but does not exhaust his being, as it does for the pantheist. Yet the distinction between theism, pantheism, and panentheism is not clear cut, since the pantheist may allow that the universe with which he identifies God is more than the commonly recognized natural universe, while the theist may well see the created universe as still somehow within God. However, pantheism typically stresses the worth of life in the natural world in contrast to Christian theism which has typically seen its values as a snare deflecting us from concern with the life to come and it may be between these that panentheism tries to stake out a middle path.

TIMOTHY L. S. SPRIGGE

Paraconsistency

The history of paraconsistent logic can be traced as far back as 1910–11 to the work of Jan Łukasiewicz (1878–1956) and Nikolaj A. Vasil'év (1890–1940). Although Stanisław Jaśkowski (1906–65) constructed the first paraconsistent propositional calculus in 1948, the development of this logic in its present form really began with Newton C. A. da Costa who, from 1954 onwards, independently constructed several such systems at both the propositional and predicate levels, as well as the corresponding calculi of descriptions and various applications in set theory. (For an outline of the history of paraconsistent logic see Arruda 1980 or da Costa and Marconi 1989.)

Paraconsistent Logic. Let T be a deductive

theory whose language has a symbol for negation. T is said to be inconsistent if the set of its theorems contains at least two formulas (or sentences) one of which is the negation of the other; otherwise T is consistent. T is called trivial (or over-complete) if the set of its formulas (or sentences) coincides with the set of its theorems; otherwise T is called non-trivial. Most common logical systems, for example classical and intuitionistic logics, do not separate the concepts of inconsistency and triviality; that is, a theory based on such a logic is trivial if and only if it is inconsistent. Paraconsistent logics can serve as the underlying logic of theories that are inconsistent but non-trivial. Using as a basis the usual paraconsistent first-order logics, we can build systems of set theory which are stronger than classical set theory. In these systems there exist 'inconsistent' sets, for instance Bertrand Russell's class $R = [x : x \notin x]$, for which we have: $R \in R$ and $R \notin R$. Yet such theories encompass in a certain sense all extant classical set-theoretical developments. Alternatively, we can also construct very strong, paraconsistent higher-order logics (da Costa 1974).

Paraconsistent Logic and Ontology. A (deductive) logic constitutes a system of very general concepts (or categories, such as those of object, class, relation, existence, etc.) on which we have an organon of inference. Since ontology can be described as a set of principles relating to the most general characteristics of what there is, it is clear that logic and ontology are intimately linked. Thus, certain principles, such as the laws of identity, contradiction and the excluded middle, have both logical and ontological formulations and, as a consequence, a change in our system of logic will normally bring with it a change in our ontology and vice versa. Paraphrasing W. V. O. Quine, we might say that to be is to be the value of a variable in a particular language with a given underlying logic. Thus, just as there are different geometries based on different sets of axioms, so we can delineate various different ontologies based on different kinds of logic. In particular, paraconsistent logics allow us to accommodate strictly inconsistent yet non-trivial ontological theories – which can be called 'dialetheic' ontologies (cf. Priest 1987). The two most obvious examples are Hegelian dialectics and Alexius Meinong's theory of objects, both of which have been criticized for involving a liberal treatment of contradiction which classical logic cannot allow. Clearly the use of a paraconsistent system removes the sting from such objections (da Costa 1982). All theories of the given sort affirm that Being includes ineliminable contradictions and this requires the replacement of classical logic by some kind of paraconsistent alternative. It is worth recalling, however, that certain paraconsistent logics locally coincide with classical systems in the sense that they can be employed in all situations in which the latter are used (again the analogy with non-Euclidean geometries is obvious).

Paraconsistent Logic and Metaphysics. If one's categorial metaphysical framework is taken to be embedded in a certain kind of logic, then the substitution of classical logic by a paraconsistent system will result in a fundamental change in this framework, thus adding a further dimension to its corrigibility (in the sense that considerations external to the framework might impel us to alter or abandon one or more of its central components). We leave open the question as to the source of such changes, involving as it does the thorny problem of what determines the choice of a particular logic. If scientific theories are taken to have a metaphysical core and if this in turn is related to some metaphysical framework, then the question arises as to whether such theories could be inherently inconsistent. Of course, this would violate a strong methodological constraint, but if the grounds for this constraint rest solely upon the argument that logical inconsistency leads to triviality, then the existence of paraconsistent logics at least makes it questionable. The embedding of scientific theories in such a logic might lead to some interesting developments. Certainly it could accommodate the fact that inconsistent theories, such as Niels Bohr's (1885–1962) theory of the atom, are not discarded immediately if they have pragmatic or heuristic worth. Interesting questions then arise regarding the logic(s) of justification and truth;

at the very least, the frequency of inconsistent theories in the history of science should give one pause for thought. Further examples of apparent inconsistencies in our systems of belief arise in the study of mental phenomena, the problem of self-deception being a particularly striking case in point. The obvious candidate for a doxastic logic fit to capture such phenomena would be a paraconsistent one (da Costa and French 1989).

Conclusion. There exist numerous kinds of logic and thus various possible ontologies, in particular paraconsistent ones. This implies, we believe, a revolution in metaphysics similar to that caused by the discovery of non-Euclidean geometries in mathematics. The problem now, of course, is that of delineating the basis on which to choose a particular logic or ontology as the most adequate one for a given situation. Whatever its final form, the answer is bound to be somewhat complex, involving a consideration of the relationships between logic, our systems of belief, and the metaphysical frameworks in which the latter are embedded.

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NEWTON C. A. DA COSTA AND STEVEN FRENCH

Paradoxes

Variety of Paradoxes. Paradox is encountered in situations in which there seem to be strong arguments or intuitions in favour of the truth of propositions that are on the other hand – because there seem to be equally good reasons for their falsity – against belief (παρά δόξαν). Within this common frame of speech there have been coined in philosophy numerous technical terms including 'paradox' (or 'antinomy') as a part: singular names (such as 'The liar paradox') as well as predicates grouping together similar paradoxes. This article is confined to examples from the two most important groups.

Set-Theoretical Paradoxes; the Theory of Types. The broad philosophical discussion of this group of paradoxes began with Bertrand Russell's informing Gottlob Frege (in a letter of 1902) that there was derivable a contradiction in the system of Frege's *Grundgesetze der Arithmetik* (two volumes, 1893–1903). The contradiction results from suitably applying Frege's basic law No. V (volume I, p. 240) to the *Wertverlauf* or, as we would now express it, to the extension of the concept

$$\exists\, \mathfrak{G}\ (\epsilon = (\text{extension of } \mathfrak{G}) \,\&\, \neg\, \mathfrak{G}\ (\epsilon)).$$

If this extension in fact existed (about which Frege had no doubts) it would be the 'set of all sets not members of themselves' – an entity since then connected with Russell's name. This class does not exist as a set. There are, then, membership conditions without sets corresponding to them – a fact which is so much contrary to any initial intuition that it may qualify as a paradox in its own right.

Already in the construction of the Russell paradox, there is involved a membership condition (or 'term of comprehension'), namely $\neg(x \in x)$, which seems to manifestly have the touch of paradox. This is not so with Burali-Forti's paradox of 1897, which therefore exhibits in an even more striking way the limitations of set comprehension: there is no such thing as the set of all (finite and transfinite) ordinal numbers. For it can be shown that for every set of ordinal numbers there exists an ordinal which is larger than any of

the ordinals in the set. Assuming the existence of a set of all ordinals, we would therefore get an ordinal which is larger than itself.

Such paradoxes reveal the need to revise assumptions not seen as problematic as long as no contradictions appeared. In the aforementioned cases, such assumptions pertain to the possibilities of collecting together given objects into new objects. Modern axiomatic systems of set theory accordingly include axioms of comprehension which restrict set generation in different ways.

Mathematical Platonism has been deeply affected by the set-theoretical paradoxes. For their occurrence made it clear that, even with regard to such a seemingly simple concept as that of set, our intellectual intuition of abstract objects, if there is such a thing, must be regulated through axioms which are not altogether natural.

Russell's way of achieving, among other things, a restriction of set comprehension is, informally, the famous vicious circle principle (see *Principia Mathematica*, 1910–13, Introduction, Chapter II, and "Mathematical logic as based on the theory of types", *American Journal of Mathematics*, 1908): no collection of objects can contain members only definable in terms of the collection as a whole. As a special case of this, no function can allow as argument the function itself or another individual only definable in terms of the function itself. For according to Russell, any function presupposes the collection of its values and arguments and is, in a sense, identical with this collection. As a linguistic consequence of that ontological principle, Russell wants to treat as ill-formed and non-significant any expression consisting of a functional expression with that very expression (or with something containing that expression as a part) occupying one of the argument places. "$\mathfrak{G}(\{x|\ \mathfrak{G}(x)\})$", for example, and composites of this expression are to count as meaningless and therefore are not admissible for set comprehension.

The vicious circle principle as it stands is, however, more restrictive than most working mathematicians are ready to accept. It would block the standard proof of the power set of a set M having larger cardinality than M. It even casts some doubt on such familiar procedures as defining the subspace generated by a given subset of a vector space as the intersection of all subspaces containing the set – thereby making use of a totality to which the object to be defined belongs. To be sure, there are other ways of introducing such subspaces. But even if this were not so, the Platonistically minded mathematician would argue against the vicious-circle-ontologist that those mathematical objects exist in their own right irrespective of our perhaps defective means of singling them out linguistically.

In Russell's Theory of Types the order attached to an object gives, in a sense, the degree to which one has drawn upon previously delimited totalities in introducing the object or a name of it. It was already F. P. Ramsey who denied the ontological import of the hierarchy of orders in maintaining that order was only a characteristic of particular *symbols* (*The Foundations of Mathematics*, 1925). Where our concern *is* with symbols, as in the case of the semantic paradoxes, the distinction of orders is still relevant. Where our concern is, as in mathematics, with the extralinguistic objects our symbols refer to, it seems reasonable (in order to avoid the set-theoretical paradoxes) to adhere at most to that part of the content of the vicious circle principle which is captured by what now figures as the Theory of Simple Types.

What qualifies in A. N. Whitehead's and Russell's *Principia Mathematica* as "The Theory of Logical Types" is, in effect, a Ramified Theory of Types. Russell seems to have understood it as a way of modelling the syntax and logic of formal systems in the spirit of the vicious circle principle. According to more recent streamlined versions, the procedure is as follows. In any context of speech, there is presupposed a realm of basic individuals we can talk about. These are assigned the type 0. We can further talk about properties of such individuals, properties of such properties, and so on. Properties count as propositional functions. Starting with the type-0 case, each propositional function is assigned a type by the stipulation:

> If a function of n arguments allows arguments of type τ_i in the i-th place, the type of the function is $(\tau_1,\ldots,\tau_n)$.

If, for example, τ is the 'highest' type of objects which a property can take as arguments, then the property itself is of the 'higher' type (τ). The property is hereby excluded from the collection of its arguments. The type-distinction of objects carries over to the linguistic level via the relation of semantical reference. Thus far we have obtained what are called simple types. In the Ramified Theory, the collections of objects of the same simple type are further dissolved into smaller collections – the so-called orders. It is not quite clear whether Russell himself, in contrast to Ramsey, took orders as real characteristics of extralinguistic objects. In any case the order of either an expression or its designatum depends on the definitional procedure by which it is introduced into our talk.

Linguistically speaking, if $\tau \neq 0$ is a linguistic simple type, then the first-order expressions of type τ are those among the propositional function expressions of type τ which do not contain a bound variable of type τ; the second order of type τ comprises those among the expressions of type τ which contain a bound variable of type τ ranging over the designata of the first-order expressions of that type, and so on for every natural number n (in type-theoretically formalized languages, variables are given an order-index in addition to their type-index). Given such a setting, axioms of universal instantiation are subjected to the following restriction: in $\forall \mathcal{F} \mathcal{A}$ there may be inserted for $\mathcal{F}$ only those propositional function expressions whose type and order are not 'higher' than the type and order of $\mathcal{F}$ (see e.g. A. Church, *Introduction to Mathematical Logic*, 1956, par. 58).

Semantical Paradoxes. Notions such as truth, falsity, and designation are semantical notions. Hence paradoxes which essentially involve such notions are classified as semantical paradoxes. Prominent among them is the Paradox of the Liar (also discussed by Russell in 1908). As applied to this paradox, the type-theoretical apparatus works as follows. Let $\mathcal{A}$ be $\forall p\,(\mathfrak{G}(p) \supset \neg\, \mathfrak{T}(p))$. Read $\mathfrak{G}$ (...) as: . . . is a proposition uttered by a Cretan; read $\mathfrak{T}$ (...) as: . . . is a true proposition. p is a propositional variable. If we regard propositions as a limit case of propositional functions (or of propositional function expressions), the type-theoretical notions are available: p is to have a certain order n, and the order of $\mathcal{A}$ is then at least $n + 1$. $\mathcal{A}$ is now not admissible as substituend for p. If it were, the contradiction that $\mathcal{A}$ is true if and only if $\mathcal{A}$ is not true would arise under two additional assumptions (namely, $\mathcal{A}$ is the only proposition ever uttered by a certain Cretan X; and all propositions ever uttered by Cretans different from X are in fact false).

The price one pays in solving paradoxes of this kind via the Theory of Ramified Types is the complete suppression of semantical self-reference. Other methods have been proposed avoiding this consequence. Barwise and Etchemendy (1987) take a course which parallels the now customary moderated type-theoretical ways of controlling the set-theoretical paradoxes. The strategy is to introduce additional parameters. In set theory, we have axioms of comprehension which no longer entail e.g. the existence of a set $M = \{x | x \notin x\}$, but entail instead the existence of sets $M_c = \{x \in c | x \notin x\}$ for classes c. We get $M_c \notin M_c$, and this does not in turn entail the disastrous $M_c \in M_c$, but entails $M_c \notin c$ (this might be interpreted as telling us that M_c is of another type than are the elements of M_c). Inspired by J. L. Austin's work, Barwise and Etchemendy supply sentences with a situational parameter s and treat the enriched objects (for which the label 'propositions' is reserved) as the real bearers of truth values. If then f_s is a proposition to the effect that f_s itself is false, the authors get the result that f_s is false (as in the set-theoretical example: $M_c \notin M_c$). But this does not imply that f_s is true. For the fact that f_s is false is to count as part of a situation $\bar{s}$ richer than the situation s which f_s refers to; as a consequence, the falsity of f_s renders true a proposition which, being still a proposition to the effect that f_s is false, carries the situational parameter $\bar{s} \neq s$; and therefore that proposition is *different* from f_s.

In 1935, by using Gödelian techniques of arithmetization, Alfred Tarski obtained the following result for languages L of a certain minimum richness (A. Tarski, "Der Wahrheitsbegriff in den formalisierten Sprachen", 1935): Let L' be a language containing L and

in addition expressions suitable for talk *about* L; then L' cannot contain a predicate applying exactly to the true propositions of L. This result, together with the observation that the use of semantical concepts in everyday language can entail contradictions as in the liar case, led to a rather sceptical attitude towards the possibilities of theoretical semantics.

According to Tarski the semantical predicates for a given (object-) language do not belong to that language itself, but to a new language: a meta-language. As for the liar case, this amounts to arguing that the liar sentence $\mathfrak{A}$ is a sentence of a meta-language for the object-language the sentences of which form the range of the universal quantifier occurring in $\mathfrak{A}$; and that therefore $\mathfrak{A}$ itself is no member of that range.

Church has argued that Russell's and Tarski's approaches are closely connected with each other (A. Church, "Comparison of Russell's resolution of the semantical antinomies with that of Tarski", *Journal of Symbolic Logic*, 1976; repr. in Martin, 1984). For presumably it makes no great difference whether one has a hierarchy of expressions within a single language or a hierarchy of different languages.

As a matter of fact, we are quite able within the framework of our natural languages to develop to some purpose a semantics of these languages. In view of Tarski's sceptical arguments, this fact needs explaining. Saul Kripke (1975) showed a way of ascertaining the existence of *partially* interpreted languages which do include their own truth-predicates. The formal settings for Kripke's constructions are inductive processes in the course of which the domain of a prospective truth-predicate T is gradually enlarged, up to a limit (a 'fixed point'). In addition, Kripke's constructions deserve attention because they yield a proposal for a general concept of paradoxical sentence (paradigm cases being sentences that assert falsity 'of themselves', as under appropriate assumptions the liar sentence $\mathfrak{A}$ does). Call a sentence paradoxical if and only if it does not get a truth-value in any of the fixed points which can be reached by starting from an admissible initial interpretation of T.

History. Naturally, the discussion of set-theoretical paradoxes started as late as the development of set theory itself towards the end of the 19th century. In contrast, the discussion of semantical paradoxes of self-reference has a tradition reaching very far back. We know that there was much debate among the Stoics on the liar paradox (details in B. Mates, *Stoic Logic*, 1953). In scholastic works on sophisms, paradoxes of this kind are often treated under the title of *insolubilia* (an example is Peter of Ailly, *Conceptus et insolubilia*, written *c.* 1372). The *insolubilia* chapter in John Buridan's treatise on sophisms has received special attention by modern authors. In his commentary, G. E. Hughes exhibits the way Buridan's method of handling the paradoxes of self-reference depends upon a semantical theory of an inscriptional type, thus matching Buridan's overall nominalistic approach (G. E. Hughes, *John Buridan on Self-Reference*, 1982). Basically, there is a remarkable similarity between John Buridan's approach and Barwise's more recent 'situational semantics'.

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ULRICH NORTMANN

Parmenides

Parmenides of Elea was born about 515 BC and died after 450 BC. His surviving writings are fragments of a narrative philosophical poem in which the narrator is represented as being driven in a chariot beyond the gates of night and day, where a goddess reveals to him

both the truth about what is and the beliefs of mortals. Her closely reasoned revelation concerning what is rests on the following two-stage argument:

1. it is possible for what-can-be-thought-or-spoken-about to be, but it is not possible for what-is-not to be, so, what-can-be-thought-or-spoken-about is;
2. consequently, what-is-not cannot be thought or spoken about, and so the goddess forbids Parmenides's narrator to say 'It is not', allowing him only to say 'It is'.

If we gloss 'thought or spoken about' as '*truly* thought or spoken about', then the conclusion of 1. is that everything that can be truly thought or spoken about – every subject of true predications – is. This conclusion is derived from the premisses that

1a. only possible beings are subjects of true predications, and
1b. only actual beings are possible.

The conclusion of 2. and of the whole argument is best interpreted as asserting that *everything is*: being is pervasive. This is derived from the contrapositive of the conclusion of 1.: what-is-not is not a subject of any true predication. This derivation requires the assumption that

1c. if something is not, then something that is-not is a subject of a true predication.

Premiss 1a. excludes true predications about *impossibilia*. In conjunction with premiss 1b. it rules out true predications about what-is-not in general. Perhaps the underlying thought here is that such a predication would amount to saying or thinking what-is-not, which in turn would not be saying or thinking anything at all.

According to premiss 1b., what can be, is; and what is, must be. There are, then, no unactualized possibilities. The motivation here comes perhaps from Parmenides's view of being as homogeneous: it is all alike, and there are no *ways* of being. (The Greek atomists, by contrast, supposed being to be heterogeneous, comprising atoms, which are, and the void, which is not.)

Behind premiss 1c., perhaps, lies the thought that if there is a non-being, then about it there will be the true predications that it *is not*, and that it *is not a being*.

Parmenides draws several corollaries from his central theses, most importantly that there is no change, no coming into being or passing away of what-is.

He likens the perfection of what-is to that of a sphere. This comparison has led some to interpret him as postulating a material plenum. Others have read him as affirming the identity of thought and being. Others have supposed him to be advocating a two-level ontology of the kind later adopted by Plato: reason prescribes a kind of being that is changeless, homogeneous, and logically coherent, but the senses seem to grasp a kind of being that changes, is heterogeneous, and is full of contradictions.

On any reading, Parmenides is clearly the father of philosophical rationalism, and the first philosopher to articulate formal or quasi-formal ontological principles such as that of non-contradiction ('It will never be proved that things that are-not are') as well as the principles 1a., 1b., and 1c. above.

The formal aspect of Parmenideanism can awaken in modern hearts the desire to subject the system to formalization. To succumb to this desire is, of course, to risk falsifying the text. For example, to render the Parmenidean 'It is' thus:

$$(\forall x)\,(x = x)$$

would be to assume that Parmenides's 'is' is purely existential, that existence can be analysed as self-identity, and that the substituends for 'it' in 'It is' are restricted to singular terms. None of these assumptions is clearly warranted by the text.

Precarious though the undertaking may be, the formalization of Parmenidean ontology will be of value if it can demonstrate the consistency of that ontology. For, the goddess's speech *seems* to be self-refuting, in that she seems to be contravening her own injunction against speaking about what-is-

not. A good formalization would distinguish object-language and meta-language. The goddess, in a meta-language, advocates the adoption of an object-language freed from the incoherencies of the language used by those of us who live *this* side of the gates of night and day.

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PAUL THOM

Part/Whole I: History

Together with the inherence of accidents in a substance and the four different kinds of cause, the relation of part and whole is the fundamental ontological relation from the point of view of Greek and scholastic philosophy. Important theories of part and whole in the history of philosophy before Franz Brentano and his pupils were those of the early atomists, of Plato, Aristotle, and Boethius, and of scholastic philosophers such as Garlandus Compotista (*c.* 1055–1102), Peter Abelard, Thomas Aquinas, Raymond Lull, Radulphus Brito (died 1320), and Albert of Saxony (*c.* 1316–90), as well as Joachim Jungius, Leibniz, and Kant.

The Atomists. Atomism is foreshadowed in the thinking of Empedocles (*c.* 490–430 BC) and Anaxagoras (*c.* 500–428/7 BC) and in their moves towards a corpuscular conception of matter. The doctrine was brought to fruition by the School of Abdera, mainly by Leucippus (430 BC) and by his pupil Democritus (*c.* 460–370 BC). These first atomists tried to solve the Eleatic problem of the passage of being into not being and vice versa, or in other words the problem of generation and destruction. The generation and destruction of body, soul, and the whole world they see as the result of the combination and separation of an infinite number of indivisible, indestructible, immutable, and imperceptible entities, called 'atoms'. In addition the atomists accepted a principle of the void as the medium in which the unexplained movement of the atoms takes place.

Since all the atoms are alike in substance, they differ in only two respects: shape and size. They have no quality save that of solidity and impenetrability. All secondary qualities originate either in the shape of the particles or in their position and arrangement in aggregates whose formation is a consequence of the collision of atoms in the void. Taste, for example, is caused by the shape of the atoms, colour by their arrangement.

The atomists offer herewith the first model of reductionism. New properties of the wholes depend on the shape or the position of their parts. In the strict sense, however, there are no wholes, but only atoms, their primary qualities and their arrangement in aggregates or heaps.

Plato. Plato discusses the relation of part to whole especially in the *Parmenides*, but also in the *Theaetetus* and the *Sophist*. In *Parmenides* Plato has the Eleatic philosopher defend both the theory that being or the one has no parts and also the theory that it has parts. If the one has no parts, it would have neither a beginning nor a middle nor an end. Beginning and end are the boundaries of everything and the one would thus be boundless or infinite. It would be shapeless, because every shape is defined by a boundary. It also would be nowhere and at no time. It also would have no measure and thus be incommensurable, because it contains no unity which would enable it to be compared with other entities.

If, on the other hand, it has parts, then the relation of the whole to these parts would be problematic. Is the whole in one part, in some parts, or in all its parts? Is the whole exhausted by its parts, or is it more than the sum of its parts? In this context Plato also presupposes two properties of the relation μ of proper parthood, namely that it is irreflexive and transitive. Here $x \mu y$ means: x is a part of y and $x \neq y$.

In the *Theaetetus* Plato analyses the

properties of artefactual wholes like letters and syllables. Is a syllable nothing but a combination of letters, or is it something more? Plato seems to think that a syllable is a whole and a unity, more than a mere sum of letters, even though we learn to write syllables and words in an analytical way by combining letters. But syllables and words have a Gestalt which is not completely dependent on the combination of letters.

Another fundamental mereological problem discussed in the *Theaetetus* is the question of the existence of simple or partless entities whose combination would yield all complex entities. Such atoms would have no properties; nothing could be said about them, because everything would be or presuppose an addition of parts. Thus 'to have parts' for Plato seems to be a necessary condition for the possibility for having individual accidents.

Aristotle. In almost all his writings Aristotle analyses and uses the relation of part to whole, especially in his *Topics, Metaphysics, Physics, Rhetoric, Poetics*, and *Parts of Animals*. The fundamental statement concerning this relation is found at *Metaphysics* 1034b32, where Aristotle says that 'part', like 'being', can be analysed or 'predicated in different ways'.

In Book Δ (1023b12–1024a10) of the *Metaphysics*, Aristotle tries to give a definition of both part and whole. He first stresses that parts are related always to *quanta*, and he then makes a difference between elements or simple parts and parts which themselves have parts. In the first sense, for example, two is not a part of three, but in the second sense it is. Aristotle adds that the first kind of part can be a measure of the corresponding quantity.

Aristotle then distinguishes different kinds of parthood. The first example he uses is the relation of species and genus and he speaks, without giving examples, of the parthood of both the species in the genus and of the genus in the species. Later, at *Physics* 210a17–20, he says that man can be part of animal and animal part of man.

A very interesting example concerns his treatment of hylomorphic structure in terms of the part–whole relation. In the case of a bronze sphere we can distinguish matter (bronze) and form (the geometric form of sphericality) as two parts which penetrate each other in the whole.

A whole, in Aristotle's view, is characterized by two properties. The first is that no integral or essential part be absent, the second that it be a kind of unity. Wholes are under one aspect living substances like man, horse, and God, and under another aspect *continua*, i.e. entities such that there is a connection between the parts. The parts, on the other hand, can be actual or potential. Artefacts, too, are to be counted among the wholes, but Aristotle stresses that 'to be a whole' is usually attributed to what he calls 'natural wholes'.

The next difference introduced by Aristotle is that between quanta possessing a beginning, a middle, and an end, or for which the order of the parts is important, and quanta for which this is not the case. The first are rightly called ὅλον 'whole' or '*ganz*' – the second have to be called πάντα 'all' or '*gesamt*'. This distinction stems from Plato, who already in his *Theaetetus* had discussed the difference between ὅλον (whole) and πάντα (all). Examples of the first kind of 'heterogeneous' whole are animals, and parts of animals like head, arm, or leg. Examples of the second 'homogeneous' whole are flesh, water, and all other kinds of liquids, but also number. There is a third kind of thing which admits of analysis in terms of both 'whole' and 'all'. These are the things like wax and cloak whose nature, though not their shape, survives transposition.

Aristotle's last analysis (*Met.* 1024a11–28) concerns the problem of mutilation. 'To be mutilated' presupposes both *to be a whole* and *to be divisible*. If an object is mutilated it has to be the same object before and after mutilation; so, for example, a cup has to be a cup before and after being scratched. Thus a handle is not a mutilated cup. A number cannot be mutilated at all, because after mutilation it would be another number.

A third presupposition for mutilation is that the order of parts be relevant for the whole. Thus only heterogeneous wholes can be mutilated, not homogeneous ones like water and fire. A fourth presupposition is that it has to be *continuous*. Mutilation is restricted always to certain parts. The cutting

off of essential parts, or of parts whose order is not important, does not cause mutilation. So, for example, we do not cause mutilation by cutting off flesh, sinew, or bone. Mutilation is only related to external or visible parts (thus, for example, not to the spleen), and to parts which are definitively cut off (so, for example, not to hair; a bald man is not mutilated).

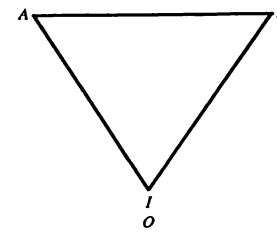
In Book Z of the *Metaphysics*, Aristotle discusses two kinds of whole. The first is what he calls a true whole, whose parts cannot exist independently of the whole. Ontologically the whole here is prior to its parts, and Aristotle takes as examples such natural objects as first substances: Peter and Susan; or second substances: human being or ox. But he mentions also artefacts like compounds of words, syllables, and so on.

The other kind of whole is not a true whole but a heap, for example, a heap of sand. In this case the parts can very well exist without the whole, so that there is no ontological priority of the whole in relation to the parts.

There are two kinds of true whole: *integral* whole or *totum integrale*, and *essential* whole or *totum essentiale*. The difference is that, in the case of an integral whole, some parts can be separated and some not. Thus the finger of a human being can be cut off without destroying the whole, but not the heart or the head. In the case of an essential whole, no part can be separated or cut off without destroying the whole. As example Aristotle and the tradition consider especially God, all of whose attributes or parts are essential, each reflecting his entire essence.

Aristotle can also be credited with having isolated a special kind of essential whole via his doctrine of hylomorphism, which sees form and matter as parts penetrating each other and therefore not able to be separated. For higher or living substances form and matter are represented by soul and body.

We can observe a homomorphism or similarity of structure between logic and mereology in Aristotle's writings. Let *A* signify: all parts are separable; *E*: no part is separable; *I*: some parts are separable; and *O*: some parts are not separable. Then in exact analogy to the classical logical triangle we have what we might call a 'mereological triangle', as follows:



A: all parts are separable
E: no part is separable
I: some parts are separable and
O: some parts are not separable

Aristotle also discusses in Book Z of the *Metaphysics* the relation between the parts of a definition and the parts of the things defined. A definition is a formula, and every formula has parts: as the formula is to the thing, so the part of the formula is to the part of the thing. Thus we are faced with the question whether the formula of the parts must be present in the whole definition or not. For in some cases the formulae of the parts are seen to be present, and in some cases not. The formula of the circle does not include that of the segments, but that of the syllable includes that of the letters. And further if the parts are prior to the whole, and the acute angle is a part of the right angle and the finger a part of the animal, the acute angle will be prior to the right angle and the finger to the man. But the second is in each case prior to the first. This is because the parts in the relevant formulae are explained by reference to the given wholes, which are prior also in virtue of their power of existing apart from the mentioned parts.

By this argument Aristotle wants to show that in a true whole, the whole is not a sum of its parts. He argues that there is in general no one-to-one relation between the parts of a definition and the parts of the thing defined. He holds that if a thing were nothing but a sum of its parts then there would be such a correspondence.

We can interpret his argument as demonstrating that the properties of a true whole are not simply the sums of the properties of its parts. A true whole has new properties which the parts do not have. In this sense some properties of the whole are not – to use

Nelson Goodman's terminology – *dissective* to the parts, and some properties of the parts are not *expansive* from the parts to the whole, they do not carry over from the parts to the whole.

A well-known example for the dissectivity and expansitivity of properties is Aristotle's theory of the continuum. Here the property 'being extended' is hereditary both from the whole to its parts and from the parts to the whole.

In the fourth book of the *Physics* (210a14–24), Aristotle distinguishes eight kinds of the relation 'being in' or of part and whole. In this text he poses the fundamental question as to the meaning of: "*A* is in or on a *B*." The first meaning he distinguishes is: the part is in or on a whole; for example, the finger is on the hand. The second meaning represents the converse relation: the whole is in or is exhausted by its parts; for example, the house is in its walls, its foundation, and its roof. The basic part–whole relation for Aristotle is: something is in a container (receptacle), or, more generally, is in a place.

A further application of Aristotle's analysis of the part–whole relation is to be found in the *Parts of Animals* (646b11–647a13). Here Aristotle points out that animals are composed of homogeneous and heterogeneous parts. The former exist for the sake of the latter in that the active functions and operations of the body are carried out by the heterogeneous parts such as the eye, the nostril, the fingers, and so on. These functions and operations are very different; they presuppose, for example, both softness and hardness, some parts must be capable of extension, others of flexion, and so on. For this reason instrumental parts of the body are compounded out of bones, sinews, flesh, and the like, but not these latter out of the former. The relations between the two orders of parts are determined by a final cause (an end or purpose).

Heterogeneous parts can be made up out of homogeneous parts, either from a plurality of them, or from a single one, as is the case with some of the viscera which, varying in configuration, are yet formed of a single homogeneous substance. But that a homogeneous substance should be formed out of a combination of heterogeneous parts is clearly an impossibility – for then a homogeneous thing would consist of many heterogeneous things. For these reasons, then, some parts of animals are simple and homogeneous, while others are composite and heterogeneous.

Another application of the theory of part–whole relations we find in the *Poetics* (1450b22–31), where Aristotle describes a tragedy as an artefactual whole possessing a beginning, a middle, and an end. A beginning is that which is not itself necessarily after anything else, and which has naturally something else after it; an end is that which is naturally after something else, either as its necessary or usual consequent, and with nothing else after it; and a middle is that which is by nature after one thing and has also another thing after it.

In the *Rhetoric* 1392a29ff, Aristotle gives examples for the topics: if the parts are possible, the whole is possible; and where the whole is possible, the parts are usually possible. For if the parts of a shoe – the slit in front, the toepiece, and the upper leather – can be made, then shoes can be made. And if shoes can be made, then so also can the front slit and the toepiece. Another example: if a whole genus is a thing that can occur, then so can the species; and if the species can occur, so can the genus.

We have in these examples two kinds of possibility: on the one hand attainability through action and on the other hand ontological possibility; the first kind is capable of admitting degrees and the second not.

Boethius. Anicius Manlius Severinus Boethius, the 'last of the Romans' and the tutor of the Middle Ages, is the link between Greek and scholastic philosophy in the case of the part–whole relation also. Boethius treats this relation in the context of his theory of the topics in *In Ciceronis Topica, De Differentiis Topicis*, and *On Aristotle's Topics*. These books are devoted to a method for the discovery of arguments.

A topic for Boethius is both a maximal proposition and the *differentia* of a maximal proposition. A maximal proposition is a self-evidently true, universal generalization, such as "Things whose definitions are different are themselves also different." *Differentiae*

divide the genus *maximal proposition* into its subalternate genera and species, and in that capacity they serve to classify maximal propositions into groups.

In his commentary on Cicero's *Topics*, Boethius quotes and takes over Cicero's division of topics into the four classes of: *from the whole, from the enumeration of the parts, from a sign*, and *from related things*.

The topic that is called 'from the whole' occurs whenever an argument is drawn from the definition of a whole term in a question (either the subject or the predicate). The topic 'from the enumeration of the parts' occurs whenever an argument is derived from the parts of a term in a question. From this it is clear that a whole, for Boethius, can be both a concept and a real object denoted by a term. Boethius discusses in this context fundamental ontological questions such as the question of the identity of a thing with the whole that is made up of all its parts taken together (a question which Boethius answers in the affirmative). A man, for example, is identical with his head, chest, abdomen, feet, and other parts conjoined and united into a single thing.

Boethius discusses the topic 'from the whole' in the following way. We draw the topic of an argument from the whole when we encompass the whole that is in the question with a definition and use the definition to produce belief in the thing that is in doubt. If someone knows all the species (parts) of a definition, he will be able to procure arguments for himself from them all, and he will find arguments more easily than a man who does not know how many species of definition there are. Evidently, following Cicero, Boethius conceives definition as a compound concept whose part-concepts can be known by a finite analysis.

Concerning the parts, Boethius points out that we speak of parts in two ways: as species and as members. A species is what takes the entire name of the whole; as, for example, a man and a horse. Each of these is called by the entire name of 'animal', for a man is an animal, and horse is also an animal. Members (or constituents) are what produce a whole and conjointly (but not individually) take the name of the whole. For example, because a foundation, wall, and roof are the members of a house, all of them taken together are called a house; but neither foundation, nor walls, nor roof are called a house.

Boethius in this text evidently takes the species as part of the genus and not vice versa. What he calls 'members' are real parts, and Boethius and the ensuing tradition discuss the inferences from the whole to the parts and from the parts to the whole using sophisticated examples (see Radulphus Brito). The first kind of example starts with the existence and non-existence of whole and parts, and was used to infer either constructively, i.e. from the existence of a whole or a part, or destructively, i.e. from the non-existence of a whole or a part. Boethius generally infers from an integral whole, but the tradition later also infers from other kinds of whole.

Scholastic philosophers. The first scholastic philosopher who uses the part–whole relation for logical and ontological analysis is Garlandus Compotista (Garland the Computist) in the 11th century. In his *Dialectica*, Garlandus treats the topics because he thinks that they are useful in the study of the hypothetical syllogism which appears to be his main interest.

Influenced by certain tendencies in the *Topics* of Aristotle, Garlandus thinks that categorical syllogisms logically depend only on the topics *from a whole, from a part*, and *from an equal*. He uses two of the maximal propositions from the topic *from a whole*, namely:

> What is universally attributed to the whole is also attributed to the part.
>
> What is universally removed from the whole is also removed from the part.

By virtue of these propositions, Garlandus formulates a mereological *dictum de omni et de nullo* for categorical syllogistic, i.e. as a rule governing the first figure syllogistic moods Barbara and Celarent, on which the other moods of the syllogism depend.

Suppose that the integral whole is a house and that we attribute whiteness to this integral whole. In this case we get a conditional in which whiteness is universally attributed to

the integral whole in the antecedent and indefinitely attributed to the integral part in the consequent: if the house is white, the wall is also white. This evidently is an example of the dissective transitivity of an attribute.

The example also makes clear that 'to be a part' must here be restricted always to a certain analysis. Thus a molecule is not a part of a house, for the purposes of Garlandus.

A century later Peter Abelard, in the *Logica Ingredientibus* and the *Dialectica*, writes extensively on parts and whole and is fascinated by what D. P. Henry calls the 'Paradox of Increase'. In order to solve this paradox an important distinction is necessary, namely that between a distributive and a collective whole:

1. Distributive whole:
   $x \epsilon_d b$ (x is one of the b's, e.g. x is a human being)
2. Collective whole:
   $x \epsilon_c b$ (x is a part of the whole constituted by the b's, e.g. is part of the totality made of human beings)

In the first case the left forefinger of a human being is not one of the b's. In the second case the left forefinger of a human being is part of the whole constituted by the b's.

Abelard was well aware of the distinction between distributive and collective wholes, both continuous and discrete, and he also uses the terms 'continuous' and 'discrete' in this connection. Collective wholes are called by him 'integral' or 'constitutive' or 'conjunctive'; distributive wholes he also calls 'universal' and 'general', as well as 'distributive'.

The Scholastics of the 13th century introduced the doctrine of whole and part into their textbooks of logic. Thus in his *Summulae Logicales*, Peter of Spain (*c.* 1210/20–77) discriminated eight kinds of part–whole relation, making more precise the Aristotelian scheme from the *Physics*.

In scholastic logic and metaphysics it is the substance–accident relation that predominates. The part–whole relation does, however, continue to play a certain role. Thus in the third chapter of his *De ente et essentia*, Thomas Aquinas sees the intensional variant of the genus–species relation as a part–whole relation. He stresses that if animal would not be the whole of what man is, but only a part of it, it could not be predicated of man, because the integral part cannot be predicated of the whole. Thus we cannot say that crow is feather, but we can say that crow is a feathered animal.

In his *Summa Theologiae* (I, q 3), Aquinas distinguishes different kinds of composition: purely quantitative, form and matter, substance and accident, act and potency. These different kinds of composition can yield also different kinds of relation of part to whole. Aquinas tries in this context to classify these different kinds of composition and to analyse their relation. Finally he distinguishes a *triplex totalitas*, or three sorts of totality, namely a totality of quantity, of form and matter, and of power or efficiency.

At I, q 76, a 8 Aquinas discusses a fundamental ontological problem: if the individual accident a inheres in y (for example, the accident white in a body), and if y is quantitatively decomposed into x_1 and x_2, then a, too, will be decomposed *per accidens*. But since $x_1 \neq x_2$, it follows that a cannot be in each of them because of the necessary feature of individual accidents that they do not migrate from one substance to another. We cannot accept that a is divided into a_1 and a_2, because a is only decomposed *per accidens*, and furthermore a quality in itself has no quantity. There seems to be a conflict, here, between mereological composition and the theory of individual accidents. A solution to this problem could be that some qualities, such as colours, do really have an analogue of quantity in themselves, since a colour is always extended. Francisco Suárez later continues this discussion.

It was also in the 13th century that Raymond Lull invented the discipline of combinatorics, the basic idea of which is that every whole or compound object can be produced by combining smallest and simplest parts and can be analysed into such smallest parts by an opposite procedure. This art, called the 'art of Lull', is conceived by him as '*Scientia generalis*', the true fundamental science, more basic than both metaphysics and logic.

From the 13th century on, Lullism remained an important element in scholastic philosophy, especially in Spain and France, and later also in Germany. Lull himself already applied the combinatoric art to sentences and parts of sentences. It was then transposed by the later Lullists to logic, that is, to syllogistic, and it subsequently became a part of mathematics, above all in the works of Girolamo Cardano (1501–76), Christoph Clavius (1537–1612), Sebastian Izquierdo (1601–12), and indeed of Leibniz himself. The basis of combinatorics as a general science is a kind of reductionism, namely the reduction of other ontological and metaphysical relations to the relation of part and whole.

Radulphus Brito treats of the part–whole relation in his commentary on the *De Differentiis Topicis* of Boethius. In *Quaestio* 9 he makes a difference between two kinds of integral whole. First is the homogeneous whole, the essence or nature of which is inherited by every part, for example water and flesh. An example of the second kind is a part of a house, which is not itself a house.

Brito now uses Boethius's terms 'to hold constructively' and 'to hold destructively' to signify confirmation or negation of the existence of the antecedent. In combination with the inferences from whole to part and from part to whole we get four possibilities:

1. The whole is (exists)
   ergo: the part is (exists).
2. The whole is not
   ergo: the part is not.
3. The part is
   ergo: the whole is.
4. The part is not
   ergo: the whole is not.

Brito then seeks to establish what are the valid kinds of inference for the two kinds of whole. For a heterogeneous whole the topic from the whole to the part is only constructively valid, because this whole is nothing else than an aggregation of its parts. Destructively it is not valid, because the parts can exist independently of the whole.

The inference from the part to the whole on the other hand is only destructively valid, because the destruction of any part destroys the whole. Thus we have the following valid inferences for heterogeneous integral wholes:

1. The heterogeneous whole is
   ergo: any part is (exists).
   The whole exists
   ergo: any part exists.
2. Any part is not
   ergo: the heterogeneous whole is not.
   (Thus for example: the wall is not; *ergo*: the house is not.)

If we look at the homogeneous whole, we have to distinguish between a quantitative and qualitative aspect. Quantitatively, there is no difference between a heterogeneous and a homogeneous whole. As examples, Brito has the sentences:

1. The whole of water is
   ergo: any part of water is.
2. This part of water is not
   ergo: the whole of water is not

But if we take into account the essence or nature of a homogeneous integral whole, the topic from part to whole is only destructively valid and not constructively. So the following is not valid: 'Water is, *ergo*: this part of water is.' The inference from part to whole, on the contrary, is only constructively valid. Thus we have the following examples:

1. The whole of water is not
   ergo: any part of water is not.
2. This part of water is
   ergo: water is.

In order to distinguish between homogeneous and heterogeneous wholes, then, we have to look at the inferences between part and whole constructively and destructively. Inferences valid for heterogeneous integral wholes are in general not valid for homogeneous integral wholes and vice versa.

It is worth analysing Brito's first counterexample, namely 'having the value of 100 marks', because in this case it is not merely the existence of whole and part that is the subject of the topic or inference, but the predication of a property. It is intuitively clear that exact quantitative expressions like

'to have the value of 100 marks' or 'to have the weight of 100 pounds' are not dissective or hereditary from the whole to its parts.

Albert of Saxony, the first rector of the University of Vienna, discusses in his *Sophismata* different kinds of mereological problems. The part–whole relation is treated in the sophisms 45–49.

In the first sophism on the part–whole relation, called by Albert 'Totus Sortes est minor Sorte', he distinguishes between a categorematic whole and a syncategorematic whole. As example Albert uses the Latin proposition: "*In oculo meo est totum quod est in mundo.*" This proposition is true if 'whole' (*totum*) is translated to mean a categorematic whole, such as: "There is a whole in my eye which exists in this world." Albert's example for such a whole is the pupil. The proposition is false if we replace '*totum*' by a syncategorematic whole as in: "All parts of the world are in my eye."

Analogous to this analysis are the problems discussed in sophism 46: "*Totus Sortes est pars Sortis*". Albert distinguishes in this context between *a*: Socrates minus one finger, *b*: the finger, and *c*: $a + b$. In this case we get the following sophism: *a est Sortes, c est Sortes* and *a* is a proper part of *c*, *ergo: Sortes est pars Sortis*. Socrates in this case is really a proper part of Socrates.

One of the solutions to this problem leads to the discussion of mereological essentialism, pursued in our own day by Roderick M. Chisholm and others. The problem can be formulated in the following way: if there are several accidental parts, then there have to be also several substantial wholes; for example, Socrates minus one finger, Socrates minus two fingers, Socrates minus one toe, and so on. In this case there would be a whole class of Socrateses, and 'Socrates' would be not an individual name but a species name of a mereological *homo Socraticum*.

In the sophism 49: "*Omne totum est maius suam parte*", Albert introduces the important distinction between a *totum quantitativum* and a *totum qualitativum*. He defines the two different notions of whole as follows:

> A quantitative whole has parts of which one is outside another and of which one is neither potential in relation to another nor could be made more perfect by another part.
>
> A qualitative whole is a whole composed of parts in which one is not outside the other and in which one part can be made more perfect by another, and this both in an accidental and in an essential way.

Albert discriminates in this sophism on the one hand between a *totum quantitativum finitum* and *infinitum* and on the other hand between a *totum qualitativum essentiale* and *accidentale*. In discussing a quantitative infinite whole Albert shows, by appealing to the case of infinite time, that one infinite whole is neither more nor less nor equal in relation to another infinite whole, because he holds that a part of an infinite whole is itself always an infinite whole.

Joachim Jungius. In his *Logica Hamburgensis* of 1638, a compendium of Renaissance logic and ontology, Jungius discriminates between different kinds of whole. The first distinction he draws is that between a *totum essentiale*, an essential whole, and a *totum quantitativum*, a quantitative whole. The latter is further subdivided into *totum quantitativum similare* and *totum quantitativum dissimilare*.

The *totum essentiale* is characterized by the mutual penetration of its parts, which are therefore not spatially separated. An example of this kind of whole is the living body which consists of body and soul, and even every physical substance compounded of matter and form. Because of their mutual penetration (or mutual *Durchwohnen*, as Brentano later calls it), the parts of the *totum essentiale* are not separable from each other.

The *totum quantitativum* is characterized by spatially distinct parts and is, regarding its parts, either homogeneous (*similare*) or heterogeneous (*dissimilare*). The parts of the *totum quantitativum similare* are of the same kind as the whole; as, for example, in the case of water. The same holds, as Jungius conceives matters, for wood, air, fire, bark, milk, and blood.

For the parts of the *totum quantitativum dissimilare* this relation does not hold. The parts of this whole differ regarding their

definition and their essence both between themselves and from the whole; as, for example, in the case of a tree, where we have: trunk, root, branch, blossom, medulla. Every animated being is a whole of this kind; thus a man has parts such as head, neck, chest, and legs. The head also is a *totum quantitativum dissimilare*, consisting of eyes, ears, mouth, nose, etc.

In Chapter XI of Jungius's *Dialectics* the division from the first chapter is further developed and refined. Thus the *totum quantitativum* is either permanent or successive, and in the latter case it is either homogeneous or heterogeneous.

For the *tota quantitativa permanentia*, whether *similaria* or *dissimilaria*, the examples from the first chapter are valid. Examples of the *tota quantitativa successiva* chosen by Jungius are: speech, discussion, conversation, comedy, tragedy, war, year (spring, summer, autumn, winter), and day (morning, afternoon).

It is important to stress that in the case of quantitative wholes we have to distinguish between *partes integrantes principales* and *minus principales*, i.e. between important parts and less important parts. An important part is one without which the whole cannot exist except as mutilated, as for example a man without an arm or a leg.

There are wholes which are purely integral, without any gradation of the parts into essential or non-essential. There are, on the other hand, wholes which are integral and essential, and which have essential and non-essential parts. Purely integral wholes are the *materia prima* or a simple being, e.g. an *entia rationis*. Examples of integral and essential wholes are all living bodies, but also artefacts like a sentence, syllogism, building, ship, and so on.

If we look at these examples, we find that among the wholes which are at the same time integral and essential are not only living entities or bodies but also non-living entities. The common feature of the latter is that they are all artefacts rather than natural entities. They are made or constructed by human beings and thus they have as their foundation something like a design or an idea of construction. The latter penetrates the stuff in the same manner as form penetrates the matter in natural objects and soul penetrates the body in living bodies. Therefore they are essential wholes and not pure aggregates. With regard to separability they also have essential and non-essential parts.

This aspect of separability of parts leads us to three different kinds of wholes:

1. *tota essentialia tantum*
2. *tota quantitativa integralia tantum* and
3. *tota quantitativa integralia et essentialia*.

It is worth noting that some wholes can be listed under 1. as well as under 3., depending on the aspect of analysis. Man, *qua* substance, for example, is an essential whole, the mutual penetrating parts of which, namely body and soul, cannot be separated. *Qua* quantitative whole, on the other hand, he is an essential and integral whole and can, for example, be an object of surgery. In this case parts are amputated and the essential ones like heart, brain, kidneys, and liver, the definitive removal of which would cause the death of the individual, have to be substituted by others.

This distinction shows that the application of reduplicative sentences – i.e. of sentences which contain particles like 'qua', 'in so far as', 'under the concept of' – is very important for the classification of different kinds of wholes. Leibniz saw this very clearly, and he used such sentences in order to discuss and to comment on Jungius's treatment of the part–whole relation.

Leibniz. Leibniz is a Lullist and in his *Dissertatio de Arte Combinatoria* of 1666 he describes the *ars combinatoria* as the metaphysical doctrine of the whole and its parts, the parts being either smaller wholes or elements. Following Aristotle, he separates the relation between the whole and its parts from the relation between the parts themselves, and he gives these different sorts of relations different names, namely 'combination' (part–whole) and 'permutation' (part–part).

The part–whole relation is important also for Leibniz's concept of possible worlds. In his *Theodicy*, Leibniz anticipates the answer to the argument of Voltaire in *Candide* to the effect that our world is not the best possible

because it contains evil and suffering. This argument, Leibniz holds, fails to discriminate between part–whole relations in the realms of quantity and of quality. Leibniz stresses that each part of a shortest distance is itself the shortest distance between its respective endpoints, but each part of a beautiful face is not itself beautiful. Thus a part of the best of all possible worlds can perhaps be worse than a part of a similar and thus comparable world that is not the best, whether in physical, metaphysical, or moral respects.

Leibniz clearly conceives the world as a qualitative whole. In his theory of the best of all possible worlds he compares similar wholes, namely the worlds themselves, first in regard of their combinatorial complexity and later also in respect to other criteria such as the relation of perceptions to apperceptions. That the best of all possible worlds may be such that its parts are themselves also the best, points to a further important aspect of the relation between whole and part, already discussed by Aristotle and Albert of Saxony. This is the aspect of heredity or transitivity of properties between wholes and parts. In the case of the best world not all parts are the best, so the property of being the best is not dissectively hereditary (not hereditary in a descending sense). By analogy with the property of being beautiful, it is evident that the property of being the best is also not hereditary in an ascending sense, or expansively, because the world which consists only of the best parts is not necessarily the best of all possible worlds. It would be too uniform and would therefore not fulfil the minimax principle.

It is worthwhile to investigate this aspect of heredity in relation to other properties also. Thus the properties of having colour or being extended are transitive in both a descending and an ascending sense, and if we follow Leibniz's argument in §64 of his *Monadology*, this is valid also for the property of being organic. Being divisible is hereditary only upwards, being inorganic only downwards. Being beautiful is neither. One could call properties that are hereditary in both directions mereologically stable or constant, and properties which are hereditary in neither direction mereologically unstable or inconstant.

The mereological structure of Leibniz's *Monadology* can be described with the help of three definitions (of 'monad', 'disjoint' and 'compound', respectively) and seven axioms:

Def. 1 Mon $(a) :<\!\!-\!\!> \neg\exists x\ (x\ \mu\ a)$

Def. 2 Disj $(a,b) :<\!\!-\!\!> a \neq b$
$\&\ \neg\exists x\ (x\ \mu\ a\ \&\ x\ \mu\ b)$

Def. 3 Comp $(c) :<\!\!-\!\!>$
$\exists x,y\ (x\ \mu\ c\ \&\ y\ \mu\ c\ \&$ Disj $(x,y))$

Axiom 1: $\exists x$ Comp (x)

Axiom 2: (Strong foundedness): every a is such that from a there is no infinite descending μ-chain, or alternatively:
(Weak foundedness): there is an a such that from a there is no infinite descending μ-chain

Axiom 3: (Transitivity of μ): $x\ \mu\ y\ \&\ y\ \mu\ z \rightarrow x\ \mu\ z$

Axiom 4: (Irreflexivity of μ): $\neg\ x\ \mu\ x$

Axiom 5: (Infinity of monads): There are infinitely many monads

Axiom 6: (Monadic constitution): Every object is either a monad or a compound of monads

Axiom 7: (Universal mereological sum): Every non-empty set of entities has a mereological sum

Of the two possibilities offered under Axiom 2, only weak foundedness is consistent with the other axioms. If we choose strong foundedness, we have to change other axioms, above all monadic constitution. Strong foundedness suggests the strong claim that every a has a foundation. These two kinds of foundedness give rise to quite different systems of monadology.

Immanuel Kant. Because of his anti-ontological attitude, the part–whole relation does not play an important role in Kant's mature philosophy and it is not included by Kant among the categories.

The young Kant, however, influenced by the monadology of Leibniz, did discuss some aspects of the relation of part to whole. Thus in his first essay in 1747, *Gedanken von der wahren Schätzung der lebendigen Kräfte*, and in his "Monadologia physica" from 1756 he discusses the relation between physical parts and their wholes. He thinks, for example,

that the fact that a physical continuum is infinitely divisible does not automatically imply the existence of infinitely many parts. Such a continuum might be infinitely divisible yet not consist of any primitive or simple parts.

For Kant in 1747 parts are real parts of a whole only if these parts have real relations to the other parts of the whole. Thus, if we conceive of individual substances as parts of our world, those substances which do not have real relations to other substances in our world must belong to another world. In this case Kant evidently accepts the existence of other possible worlds, and he concedes that God could even have created millions of other possible worlds.

The later Kant in his critical writings sees the whole as constructed or constituted by *Anschauung, Vorstellung* or by thought, the parts of which are either perceptions or apperceptions. Even matter is a pure phenomenon, constructed by imagination (*Vorstellung*), and therefore infinitely divisible, containing infinitely many parts. By now, however, the part–whole relation has become transposed from metaphysics to epistemology, and it is not until some hundred years later that a truly ontological treatment of these matters becomes once more possible.

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HANS BURKHARDT AND CARLOS A. DUFOUR

Part/Whole II: Mereology Since 1900

Despite the central ontological importance of *part* and cognate concepts, *mereology*, their formal analysis, is recent. A formal theory of part and whole was first mooted by Edmund Husserl in the third of his *Logical Investigations* (1901), where it was linked to other ontological concepts such as existential dependence. Modern formal theories were first worked out independently around 1915 by Stanisław Leśniewski (*Foundations of a General Theory of Manifolds*, 1916, in Polish) and A. N. Whitehead (*An Enquiry Concerning the Principles of Natural Knowledge*, 1919) and further developed by them in the 1920s. Leśniewski's more exact theory was inaccessible to non-speakers of Polish, and most readers discovered formal part/whole theory through the calculus of individuals of H. S. Leonard and Nelson Goodman (*Journal of Symbolic Logic*, 1940), later modified in Goodman's *The Structure of Appearance* (1951). Since 1945 Leśniewski has become better known, interest in the transtemporal identity of continuants has led Roderick M. Chisholm (*Person and Object*, 1976) and D. Wiggins (*Sameness and Substance*, 1980) to reintroduce mereological themes into general ontology, and general philosophical interest in mereology is increasing. Though the history of part/whole theory in this century has been largely that of formal axiomatic systems, mereology belongs squarely to ontology rather than to logic.

A prerequisite for mereology to emerge is the distinction between a whole, i.e. an individual with several parts, and a class. Classes, whether seen as distributive pluralities or abstract sets, are not wholes: pluralities are many and not one, sets are inevitably abstract, while a whole of concrete parts is itself concrete. Part and whole, unlike element and class, are of the same type.

Mereology usually concentrates on concreta, application to abstracta being largely unexplored. Because often yoked to ontologically parsimonious theories as a partial substitute for set theory, mereology has suffered to the extent that stronger instruments have proved necessary and popular.

But mereology is tied by no internal necessity to nominalism or extensionalism. The exploration of both formal properties of part/whole relations and their widespread ontological applications is far from complete.

Principles of Tenseless Mereology. The part relation may be taken as tensed or tenseless. We consider first the simpler tenseless version. Most mereologies, because of their intended use as substitutes for set theory, go beyond the minimum strength of theory required for a conceptual analysis of the part relation. We develop first this *minimal mereology* and show how it can be extended. As implicit background suppose a free predicate logic with identity, in which singular terms need not denote. Assuming as undefined the relation a is a *part* of b (taking 'part' to mean 'proper part'), we may define the relations:

a is *ingredient* of $b =_{Df.}$ a is part of b or a and b exist and are identical
a *overlaps* $b =_{Df.}$ a and b have a common ingredient
a is *disjoint* from $b =_{Df.}$ a and b exist but do not overlap.

The essential properties of the part relation are then

EXIST: If a is part of b, both a and b exist
ASYMM: If a is part of b, b is not part of a
TRANS: If a is part of b, and b of c, then a is part of c
SUPPL: If a is part of b, b has a part disjoint from a.

We shall take these to determine the minimal theory of the part relation. EXIST leaves a way open for temporal and modal mereologies which take non-existence (at a time, in a world) seriously. SUPPL has occasionally been denied, e.g. in the theory of substance and accident of Franz Brentano's *Theory of Categories*, where an accident has a substance as part without a supplement. In general, however, it is accepted that SUPPL is partly constitutive of the concept *part*. It is nevertheless of interest to consider dropping or weakening this axiom, adding further to the wealth of formal systems already available when considering the formal properties of *part* and its cognates. Most mereologies take as axiomatic in addition:

EXT: If a and b exist and have the same ingredients they are identical.

Although often unobjectionable, this *mereological extensionality* is nevertheless independent of the minimum theory, as we shall see when we come to tensed mereology.

Mereologies often add conditional existence postulates (cf. R. A. Eberle, *Nominalistic Systems*, 1970): that any two overlapping individuals have a unique greatest common part; that any two existing individuals make up a mereological sum; more strongly

SUM: Any non-empty class of existing individuals has a *unique* mereological sum, i.e. an individual which something overlaps iff it overlaps some individual in the class.

The system consisting of the minimal principles plus EXT and SUM yields the most familiar *classical extensional mereology* (CEM), which is Leśniewski's Mereology and the Leonard/Goodman Calculus of Individuals, modulo the differences of underlying logic. CEM is algebraically indistinguishable from a complete Boolean algebra without zero (Alfred Tarski). Some reintroduce zero as a convenient fiction by analogy with the null class, but this offends against most mereologists' robust sense of reality. In CEM we have, if anything exists, a mereological maximum, the sum of all individuals, which is sometimes taken as denotatum for the term 'universe'. Given that individuals may be widely separated in space and time, SUM enjoins the existence of scattered individuals. Both the universe and, more often, scattered individuals have been denied. Thus Whitehead's mereology has no universe and recognizes only spatio-temporally connected individuals. Those who deny SUM need to explain what distinguishes 'good' (integral) wholes from 'bad' (summative) ones. Here again we need detailed investigations of different systems to see which best fit particular cases. Work of this sort is found in the tradition of

Gestalt theory, e.g. in the writings of Edwin Rausch.

Even CEM leaves open the question of atomism, whether all individuals are composed of atoms (individuals without parts) or whether everything has a part. Both are consistent with CEM. Atomistic mereology is conceptually simpler and has finite models, but the present state of physical theory gives no strong reason for preferring either thesis.

Tenseless extensional mereology applies especially to tracts of space and time and to masses of matter. It also well suits occurrents such as events, processes, and states, which may have temporal parts and for which the part relation is not significantly tensed. The battle of Borodino was part of Napoleon's Russian campaign, but since the battle is an occurrent whose time is intrinsic to it, the question *when* it was part of the campaign is ill-posed. For such entities it also makes no sense to speak of their changing their parts. Some philosophers 'construe' continuants (organisms, natural bodies, artefacts) as processes with temporal parts, and therewith as amenable to treatment by tenseless mereology. Reasons of convenience and scientific authority are given, but a hidden motivation may be to keep EXT. Opinion about the acceptability of this move is divided.

Tensed Mereology. If one accepts continuants – individuals which exist throughout an interval but have no temporal parts – then a tensed existence predicate and tensed part relation must be considered. The principles a tensed mereology fulfils can be obtained by tensing existence and part predicates and slipping in an 'always' with maximum scope in the axioms EXIST to SUPPL above. Important questions concern temporary parts like childrens' milk teeth. Intuitively it is evident that some parts of continuants are permanent, belong to them as long as they exist, others are only temporary. Both possibilities are consistent with the tensed mereological axioms. The atoms in a water molecule, the nucleus of an amoeba, are permanent parts. Multicelled organisms probably have no permanent parts. The question of permanence seems largely empirical, though some philosophers, such as Leibniz and Chisholm, suggest that no object in a strict sense ever gains or loses parts. Whether one agrees or not, the challenge remains to give a correct account of the identity through time of continuants which undergo flux of parts. It is here that we seem to find counterexamples to a tensed version of EXT: a person and her body, a fist and its hand may be distinct continuants having the same parts at any time at which both exist. If this is correct, then more than one individual can be in the same place at the same time, though if this occurs they must be different in kind.

Modal Mereology. Modal mereology is much less developed. The main issue to date has been Chisholm's *mereological essentialism*: no object (in the strict sense) could have parts other than those it actually has. It seems that most things have some parts essentially and others accidentally, depending on kind. Mereological essentialism is plausible for tracts of space and time, masses of matter, perhaps events, but not for artefacts or organisms. The interplay between temporal and modal concepts leads to subtler distinctions, and modality allows one to distinguish like Husserl between parts which can and those which cannot survive outside their wholes.

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PETER M. SIMONS

Passion

Aristotle and Aquinas. Aristotle's list of the ten categories by means of which affirmations are made includes substance first as it is substance of which the other nine categories are predicated. The next to last and last categories are: doing and being-done-unto (action and passion). Action and passion, as absolutely general categories of substance, pertain to stones, plants, and animals, as much as to human beings.

Much of the metaphysical analysis of pas-

sion from Aristotle to Aquinas focused on two questions:

1. Does the category of passion apply to incorporeal beings?
2. How do the passions of the human soul relate to the intellect and the body?

To answer these questions Aquinas distinguished two senses of 'passion' (*De veritate*, q.26). In the broad and general sense passion is the reception of anything in any way. In its narrow and proper sense (which is a species of the broad and general sense), passion is the reception of a contrary into a material entity, e.g. the reddening of a green leaf in autumn.

Not all actualization of potentiality constitutes a passion, however. Potentiality can be active or passive. A being has active potentiality when it has potentiality which is actualized primarily by a principle internal to itself, as when a caterpillar becomes a moth or a human chooses to become a protester against an injustice. A being has passive potentiality when it has potentiality which is actualized primarily by a principle external to it, as when a piece of wood is carved into the shape of a platypus or a human is rendered prone by a blow to the head. Actualization of active potentiality is, then, something that a being does, and therefore it is not a passion, whereas actualization of passive potentiality is something that is done to a substance. Hence, it is actualization of passive potentiality only that constitutes passion in either the general or the proper sense.

In answer to 1. above, Aquinas argued that angels can have passions in the general sense, since angels are spiritual substances and therefore can receive, e.g., new knowledge; but they are not corporeal substances, and therefore they cannot have passions in the proper sense. God, by contrast, is pure act; hence he has absolutely no passive potentiality, and therefore he is not subject to passion in either the proper or the general sense.

In order to answer 2., Aquinas distinguished the intellect as active from the intellect as passive. The intellect is an agent that seeks knowledge; yet in order to acquire knowledge it must also be a patient, as learning takes place by the intellect's receipt of forms from the object of knowledge. Because the intellect, active and passive, is immaterial, it cannot have passions in the proper, narrow sense. Moreover, passions in the proper sense require appetite, of which there are two kinds. The higher appetite desires only the good taken absolutely; therefore it need not be aroused or expressed by a bodily change. The so-called 'passions of the soul', however, are generated by excitement aroused in the lower, i.e., bodily, appetite. Hence, in the narrow, proper sense, passions pertain directly only to the body.

However, passions pertain indirectly to the soul in two ways. (1) The soul is the form of the body, so what happens to the body, e.g., an injury, can and often does find expression in the soul, e.g., a feeling of pain caused by the injury. (2) A passion can be aroused in the body by the soul either (a) unintentionally, as when the importance of a new insight or the intensity of an act of will arouses by natural overflow a relevant bodily state, or (b) intentionally, as when the will purposely excites bodily energy to enhance the likelihood of defeating a formidable foe. Passions of type (1) are called 'bodily passions'; those of type (2), 'psychical passions'.

Passion as the Qualitative Ingredient of Life. According to Aquinas emotional passion, properly speaking, is located in and limited to the body. The soul may feel a passion, and that feeling of the passion is in the soul, but the passion itself is in the body. The soul feels passion somewhat as fingers feel the texture and temperature of a physical object. To be sure, the soul may consent to and follow passion, but the very possibility of such following presupposes that the follower is different from the followed. Further, the higher appetite may lead the will to arouse passion in the body so that the supranormal energy of passion can be used to accomplish an arduous objective; but strictly speaking the passion is in the body and is used by the soul. Aquinas, then, maintains a firm distinction between body and passion on the one hand and intellect, will, and spirit on the other.

In contrast to this tendency to see passion as external to the soul, many modern and

contemporary philosophers find emotional passion to be the qualitative ingredient of human life and a key to understanding ourselves, ultimate reality, and our relation to it. This shift of perspective seems to be one expression of the modern tendency to begin with subjectivity and then reason outward rather than vice versa. René Descartes, an example of this shift, said that, "It is on the passions alone that all the good and evil of this life depends" (*The Passions of the Soul*). David Hume said that life without passion "must be altogether insipid and tiresome" (*An Inquiry Concerning the Principles of Morals*). The contemporary American philosopher Robert Solomon argues that, "It is our passions, and our passions alone, that provide our lives with meaning" (*The Passions*, 1976).

Thus there is a deep contrast between Aquinas's conception of passion as a state of bodily arousal and the modern conception of passion as a mental state that is enthused, unified, and directed by strong feeling. In the latter sense, a passion has evaluation, cognitive, and appetitive features; it involves a state of affairs that is desired, an evaluation of that state of affairs as good, belief or enquiry about how one is causally connected to that state of affairs, and a dominant intention to sustain or actualize it.

From this new perspective numerous relations between passion and reality become visible. We begin life experiencing noncognitive discomforts and pleasures. By natural activity and good fortune we discover the good of relief from unpleasant states, the good of pleasure unmixed with pain, and our causal connections to these goods. From these discoveries naïve hedonic passion emerges, i.e., intentional pursuit of objects from which we have been conditioned to expect pleasure and avoidance of objects from which we have been conditioned to expect pain. Gradually we grow beyond this stimulus–response relation to the world and acquire the concept of happiness, i.e., the idea of "the satisfaction of all our desires, *extensively*, in respect of their manifoldness, *intensively*, in respect of their degree, and *protensively*, in respect of their duration" (Kant, *Critique of Pure Reason*, B834). Henceforth we are not merely pushed and pulled by specific pains and pleasures, as are animals, brutes, and children. Rather, as optimistic naturalists we are lured and guide ourselves by the hedonic ideal of happiness.

Arthur Schopenhauer (1788–1860), a pessimistic idealist, warned that our natural passion for happiness cannot be satisfied because it is always and only a finite expression of the eternally blind and restless Will that is at the heart of reality. Our only escape from Will's insatiable craving is to ignore and resist as much as possible its lying promises and seductive urges (*The World as Will and Idea*).

Hegel, an optimistic idealist, taught that the passion for personal greatness is the means through which Absolute Spirit uses unwitting humans to achieve ever higher progress in history (*Lectures on the Philosophy of History*). Beyond the pursuit of personal greatness lies the possibility of unselfish devotion to greatness itself. This last mode of passion rejects the idea that it is oneself that is the proper object of devotion. It consists of wholehearted allegiance to something that one believes to be worthy of such devotion because of its great goodness, e.g., beauty, knowledge, or world peace. Note that here we begin to see the use of reason as more than "a slave of the passions" (Hume, *Treatise*); now it is a tool for determining what is truly worthwhile (Kant, *Critique of Judgment*).

Theists believe that God is the only appropriate object of wholehearted devotion and that devotion to God is the only way to overcome our spiritual dissatisfaction. Augustine put this point in prayer: "Our hearts are restless 'till they find their rest in Thee" (*Confessions*, 1.1). Blaise Pascal (1623–62) said there is an "infinite abyss" in each of us that "can be filled only with an infinite and immutable object; in other words by God himself", who alone is "man's true good" (*Pensées*, 148). Søren Kierkegaard (1813–55) argued that it is by passion, not belief, that we enter an appropriate relationship with God. The religiously important questions are not 'Have you examined all the evidence pertaining to the existence of God?' and 'Does that evidence justify belief that

God exists?', but rather, 'Do you love the idea of God?', 'Do you hope that God exists?', 'Do you passionately want to know and be devoted to God?' (*Concluding Unscientific Postscript*).

Jean-Paul Sartre agreed that passion is religious: "To be man means to reach toward being God. Or if you prefer, man fundamentally is the desire to be God". But, he added, there is no God, and we cannot become God, so "man is a useless passion" (*Being and Nothingness*). None the less, Sartre urged, we can devote ourselves to being rigorously circumspect in our choices of projects for the expression of our passion and utterly guileless in accepting responsibility for them.

Yet is not devotion, whether theistic or atheistic, an action rather than a passion? Passion typically involves a surge of physiological agitation that is triggered by circumstances and has an inertia that is partly independent of our wills, forcing feelings, thoughts, desires, and perhaps behaviour upon us. By contrast, devotion endeavours to be rightly related to its object even when the individual must force herself by sheer exertion against temptation, weakness, or aversion to do what is called for; so how can devotion be a mode of passion?

A partial answer is that sometimes passion is triggered because of our genetic endowment or history of conditioning – and therefore is impulsive and involuntary, but other times passion obtains and endures because of rational considerations – and therefore is reflective and voluntary. The latter kind of passion is similar to Aquinas's 'psychical passion', but without the necessity of some kind of abnormal body energy being aroused. As examples of reflective passion consider Socrates's "deep passion" for philosophical debate (*Theatetus*, 169b), Plato's emphasis on the importance of "the passion for a beauty which is spiritual, not physical" (*Laws* 8.841c), and Jean-Jacques Rousseau's (1712–78) urging that we cultivate "the passion for virtue", subordinating all other passions to it (*Emile*).

We each begin life in the mode of impulsive passion. In so far as we live life according to reason we live it less and less as impulsive passion and more and more as reflective passion. In our capacity to make this transition lies our personal autonomy and the openness of life. In making this transition lies our dignity and fulfilment. Clearly, then, passion is an integral part of human being and an important vantage point from which to consider the nature of ourselves and the reality of which we are a part.

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Passive Affection

Three uses of '*pathos*' (affection) recognized by Aristotle were:

1. an accidental, i.e. non-essential, property;
2. an emotion;
3. an undergoing, i.e., a passion as distinguished from an action (*Cat.* 8b25–10a 16, *Met.* 1022b15–21).

The dominant tradition from ancient Greece to Spinoza was roughly as follows. Affections in sense 2., i.e., emotions, are a species of 3., i.e., passion. Emotions being involuntary, we are not responsible for their occurrence. However, we have freedom of will, so we are responsible for how we *respond* to them. Moreover, eventually we do begin to acquire responsibility for our emotions because some of our responses to them influence their recurrence, frequency, intensity, aim, etc. Hence, though we cannot be responsible for the early occurrences and characteristics of our emotions, we can become greatly responsible for them later.

Spinoza on Passive Affection. Spinoza rejected the mainstream belief that we are morally responsible for our actions and therefore to some extent for our affections, i.e.,

that we could have performed different actions and therefore to some extent could have had different affections. Yet he also rejected the notion that affections are essentially passive phenomena. Using '*affectio*' for 'accidental property' and '*affectus*' for 'emotion', Spinoza distinguished the latter into passive and active affections.

A passive affection is one that is caused at least partially by factors external to the understanding of the experiencer. The ignorance from which a passive affection arises means that the individual lacked the power to check or control his affections in that instance and therefore was to some extent at the mercy of fortune. An active affection is one that the individual willed with adequate understanding of its connections, costs, and consequences. An affection, then, can be the result of an action, a passion, or some combination thereof. The smaller the role one's understanding plays in producing one's emotional life, the more victimized one is by external factors. The greater the role that understanding plays in the producing of one's emotional life, the freer one is from luck and emotional bondage.

Identifying self-contentment as the highest good for which humans can aspire (*Ethics* IV.52.s), Spinoza argued that the more completely we are in control of our experiences, the more content we will be with our lives and ourselves. It is by the exercise of reason and reason alone (our power of understanding) that we can gain more control of the emotional aspect of our lives, as well as of the physical aspect. Moreover, reason has several strategies for pursuing this end, but whether reason or external factors will prevail in determining one's emotion and behaviour on any particular occasion will depend entirely on their strengths relative to one another at that time. External factors – which include physiological as well as environmental factors (IV.6) – are often stronger than reason, especially earlier in life.

Sartre on Affection as Chosen. Jean-Paul Sartre, as extreme a believer in free will as Spinoza was in determinism, argued that the most challenging human problem is not how to gain more control of our emotions; it is how to get ourselves to admit that we already *are* completely in control of our emotions (*Sketch for a Theory of the Emotions*). Sartre saw determinism as a cowardly way of abjuring personal responsibility. Spinoza, for example, spoke of the possibility of gaining increasing control of our lives by means of reason, yet he denied that we are ever free to choose whether or not we will do so. Moreover, he held that the ultimate achievements of the active mind are to see the general necessity of all events, the specific necessity of each event, and to will each emotion or action because one understands its necessity and that it is part of the perfection of nature.

Sartre claimed that no human emotion or action is necessary. The only reason our affections might be said to be passive is that we impose them on ourselves – but even that is misleading. What we really do is *constitute* ourselves of them. We are nothing more than our actions, and our actions include our choices of emotion as well as of behaviour.

God and Passive Affection. The topic of passive affection has also motivated much 20th-century theology. The dominant Western conception of God until the 20th century conceived God as absolutely and immutably perfect. It follows from this and the assumption that bliss is a perfection that God is absolutely and immutably blissful. Critics such as Charles Hartshorne (*Man's Vision of God*) object that if God is immutably blissful, then he cannot be touched emotionally by our miseries and joys, or repentance and prayers. But reason and Scripture both indicate that God can be moved in these ways. Therefore the classical conception of God is flawed. God, as a perfect personal being, should be conceived not as impassive but as perfectly passive, i.e., perfectly sensitive and empathetic, in relation to his creatures. Moreover, God conceived as perfect love must be conceived as sorrowing with us in our sorrows and rejoicing with us in our joys. Richard Creel, by contrast, argues that emotional suffering with others is not a necessary condition of knowing, loving, and caring for them; hence, God can be perfectly loving without his emotional life being a function of the emotional lives of his creatures.

See also: **Passion**

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RICHARD E. CREEL

Paul of Venice

Paul of Venice (*c.* 1369–1429) left his native Udine in his early teens and joined the Hermits of St. Augustine at the Venetian convent of Santo Stefano. Later assigned to the *Studium Generale* at Padua, he was sent with his older cousin in 1390 to study theology at the *Studium Generale* in Oxford. Due to his youth, however, he was prohibited from ordination while abroad. Returning to the Paduan convent, he advanced through the academic ranks until 1401, when he completed his *Abbreviatio* of John of Ripa's (fl. *c.* 1355) *Commentary* on the *Sentences* of Peter Lombard (*c.* 1100–64). By 1405 Paul had delivered his *Lectura super librum posteriorium analyticorum*, the fourth of five major works in logic which have been attributed to him. The others are *Logica Magna* (1397), *Quadratura* (1399), *Logica Parva* (1401), and finally the *Sophismata Aurea*, which did not appear in manuscript form until 1416. Between 1405 and 1409 Paul taught at the University of Padua and completed two major works: *Summa Naturalium*, a commentary on Aristotle's major works in natural philosophy, and a lengthy *Expositio super octo libros physicorum* (1409).

In 1409 Paul was named prior general of the Augustinian Order by the Roman pontiff Gregory XII; four months later Alexander V was elected pope and rescinded the appointment. For the next ten years Paul's academic life was interrupted several times. As ambassador of the Venetian Republic in 1409 he travelled to Germany, Poland, and Austria. Between 1415 and 1420 he was censured by the Council of Ten, forbidden to travel to the Council of Constance, and exiled to Ravenna. After a stay in Siena and a brief visit to Bologna, he was assigned to the convent in Perugia from 1424 to 1428, where he completed a number of lengthy works including *Expositio super Praedicabilia et Praedicamentorum, Lectura super de Anima*, and *Lectura super librum Metaphysicorum*. Paul returned to Padua where he died in 1429.

More than twenty works attributed to Paul of Venice survive in 225 manuscripts. Several were reprinted in numerous editions. The two most influential works were *Logica Parva* and *Summa Naturalium*. The former manual introduced students to the basic concepts of Oxford logic, e.g. terms, suppositions, consequences, proofs, obligations, and insolubles. These topics were essential to Paul's approach in the latter work, which combined the Oxford calculatory tradition with Aristotelian natural philosophy. In other works Paul reveals that he is conversant with Parisian nominalism and Averroism as well as with traditional sources such as Thomas Aquinas, Albert the Great and Robert Grosseteste (*c.* 1175–1253). Familiarity with the Oxford and Parisian materials is surprising, for there is no documentary evidence that Paul studied logic and science at Oxford, and there is strong evidence against his ever having studied at Paris. In fact, his order forbade such study during the Schism. Paul's grasp of these doctrines seems to have been based on texts available at Padua and an active commentary tradition practised in the Paduan convent. Paul founded the Paduan School of natural philosophy which emphasized scientific methodology. It combined nominalistic techniques in logic with a realistic Averroism in science and metaphysics. Gaetano di Thiene (1387–1465) and Paul of Pergula (died *c.* 1451/5) continued this tradition at Padua, a tradition which exerted a strong influence on scholastic logic, science, philosophy, and theology in Italy during the *quattrocento*. Its arid Latin style was then a major factor which provoked a rising tide of attacks by humanists on scholasticism during the 15th and 16th centuries.

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ALAN R. PERREIAH

Peirce, Charles Sanders

C. S. Peirce, American philosopher and logician, was born in 1839 in Cambridge, Massachusetts, and died in 1914 in Milford, Pennsylvania. Having taught briefly at Harvard and Johns Hopkins (influencing William James among others), from 1887 he worked on logic and philosophy in isolation. Best known for his pragmatism and contributions to the theory of signs and the logic of relations and quantification (discovered independently of Gottlob Frege), he was also a systematic philosopher, following Kant in using logic to ground metaphysics. He published many articles and tried to write several Logics. His influence has grown since his death, due to *Collected Papers* and the more recent *Chronological Edition*.

Peirce's 'pragmatist principle' (1870s) holds that the whole meaning of a conception is determined by experiences expected as consequences of acting in different ways. Much metaphysics thus has no meaning. Applied to *truth* or *reality*, a true proposition is one fated to be agreed upon by the whole community of enquirers. Realism about universals was thereby vindicated, since the issue was seen to concern the objectivity of propositions containing predicates rather than the existence of abstract objects.

A theory of categories underpins all of Peirce's work. An adequate language requires monadic, dyadic, and triadic predicates, expressions with different 'valencies' or different numbers of 'unsaturated bonds'. Emulating Kant's metaphysical deduction Peirce thereby classifies the elements of reality. Monadic predicates express forms of *firstness*; dyadic predicates express *secondness*; triadic predicates express *thirdness*. Thus, for example, the sign relation exemplifies thirdness: a sign denotes an object because other thoughts or signs interpret it as doing so. Using his categories, Peirce classifies signs into different sorts and constructs a sophisticated philosophy of mind and language.

Peirce uses three arguments for his categories:

1. From 1860s: properties of objects are understood as potential points of similarity, and similarity is a dyadic relation. Discerning similarities involves interpreting one object as a sign of another. Property ascription thus presupposes grasp of dyadic and triadic concepts.
2. From 1870s: he exploits a metatheorem of his (non-standard) logic: relations with a valency of 3 are indefinable by relations of lower valency, relations of higher valency can be defined using triads.
3. After 1890: *phenomenology* investigates the general features of the *phaneron* (the totality of what appears), confirming the adequacy of the three categories.

Thirdness is mediation: examples are signs, actions like giving (a favourite example), and most mental phenomena. In later work, Peirce analyses continuity as 'ultimate mediation' and attempts to derive an extreme realism concerning universals and natural necessity from the presence of continuity (thirdness) in nature. Where thirdness is the mode of being of signs, law, and necessity, secondness encompasses actual existence: it is manifest in experience of brute reaction, effort, and will. Firstness was linked to quality, to the sensuous character of experience, to spontaneity and possibility. In spite of their allusive character, Peirce's phenomenological claims are suggestively applied throughout his work.

Peirce uses the categories to describe the objects of aesthetic appreciation, the ends of life, and the aims of enquiry. They also ground his explanations of how scientific method leads to truth. They also provide the materials for his scientific metaphysics

(developed after 1890) which tries to describe the conception of reality required by logic and the success of science without clashing with pragmatism. A form of objective idealism, which explains natural law as analogous to inference or sign interpretation, offers an evolutionary explanation of law from an ideal starting-point of pure firstness; Peirce's *tychistic* doctrine that the universe displays pure chance or spontaneity has a role in this explanation.

See also: **Peirce and Scholastic Metaphysics**

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CHRISTOPHER J. HOOKWAY

Peirce and Scholastic Metaphysics

Medieval philosophy exerted a deep influence on Peirce, who called himself a "Scotistic realist of a somewhat extreme stripe". In spite of some Ockhamistic tendencies in his earlier writings (e.g. in his works on relations and in his deduction of a new list of categories based on the theory of *suppositio*), Peirce very soon turned to John Duns Scotus, not only because of the subtlety of the latter's logic, but mainly because of his metaphysics and his realistic – though not Platonistic – solution to the problem of universals.

Following Avicenna, Duns Scotus distinguishes logical, physical, and metaphysical universals. The metaphysical universal is the Common Nature, which is the subject of primary intention and exists in many individuals of the same species. It does so, however, not under the form of an actual existence, but in a state of positive indeterminacy or indifference. It is neither a singular endowed with numerical unity, nor a universal with no other unity than the unity of logical predicability, but rather something 'in between'. The physical universal is the result of a 'contraction' of the Common Nature in its original state of indeterminacy to the mode of individuality, by addition to the Common Nature of the principle of individuation (the '*haecceitas*'). The logical (or second intentional) universal conveys logical or intellectual unity to the metaphysical universal, but no real or metaphysical unity.

For Peirce, to follow John Duns Scotus means to admit metaphysical or real formalities not as Platonic entities, but as entities which cannot be reduced to physical parts or to conventional names, since their real unity, though discovered by the intellect, is not produced by it. Logical generality must be distinguished from real community. Such an irreducible indeterminacy or indifference of the '*ens reale*' is the first important lesson to be learned from Scotus's commitment to real universals (5.312). The second is that the '*quod quid est*', which is the proper subject matter of metaphysics, falls midway between the domain of the physicist who considers it through its concrete determinations, and the domain of the logician who views it as being determined to logical universality.

Such are the essential features of real universality: Peirce detects and analyses it in everyday life (with the help of his 'phenomenology'), in knowledge, where Peirce defends an alliance of realism with fallibilism, in thought-signs, in logic (especially through his logic of vagueness), and also in his theory of science and throughout his evolutionary metaphysics.

Suppose a cook has to prepare an apple pie; she will start by following a set of rules according to her recipe-book. She does not think of any particular apple pie that she would like to serve, although it is an apple pie that she wishes to serve, and to someone in particular (1.341). Similarly, even if she must use particular apples, she will be indifferent as to which particular apples, because what she wants is perhaps some species or some quality of apple, but no particular apple. The scientist's attitude is very close to the cook's. He does not look for the particular sample but for the molecular structure (4.530), namely, some nature which is not *in itself*

particular (for the singular case is but a contraction of that nature) nor universal (for universality is not actual but potential, under the form of some habit, disposition or tendency – or, as Peirce calls it, a 'would-be') (5.425).

This also explains why Peirce finally departs from Scotus, whom he finds too moderate and only separated from nominalism by a hair's breadth: real universality must not only be indeterminate relative to the mind: it must be so *in re* (8.208). Now, in spite of various modifications in his logic, especially after 1885 with the introduction of indices and the first attempts towards a logic of quantifiers; and in spite also of the increasing role played by the category of existence or reaction (at times identified with Scotus's '*haecceitas*'), Peirce holds on to the view that an absolutely determinate individual is impossible (3.93). While denying the Scotistic contraction, Peirce claims the reality of law, mediation, or generality: the universal *in re* is not a singular having something in common with all the singulars of its species. It is law. The real question is no longer: are universals real? It is: are *laws* or *general types* real, or are they pure inventions of the mind? (1.16).

To demonstrate that the laws or general principles are really operative in nature (5.101), one has to keep away from a second error made by Scotus: not to conclude too quickly from logic to physics (6.361), or from the existence of the appropriate general term to a corresponding real nature. Scientific enquiries can show only that things which have the same name are really similar and that there exist in reality real laws and not mere accidental uniformities. Here lies the natural link to be made between pragmatism and realism which affords the right adaptation of the Scotistic inheritance to modern science. Indeed, the scholastic form is too static to reveal the essentially *relational* structure of things. Peirce's new logic of relatives puts into relief the fundamental role played by what now becomes the 'real universal': *continuity*.

The pragmatic maxim now affords the basis of the method to be followed in science: the meaning of a concept or proposition is given by another proposition which is but a general description of all the experimental phenomena virtually predicted by the statement of the initial proposition. For example, the meaning of the term 'hard' or of the proposition 'this is hard' can be expressed in the following manner: 'not able to be scratched by many other substances'. It is in this way possible to identify any categorical proposition with a hypothetical proposition or with a set of conditionals. The antecedents prescribe the operations to be performed, while the consequents specify what observable results will ensue if the operations are performed and if the proposition is true. Peirce soon interprets the conditional in a subjunctive way, and depicts his position as one of extreme scholastic realism (8.208): a statement of conditionals becomes synonymous with the expression of a law or habit governing experience and constituting the ultimate meaning of every proposition (5.450).

Peirce's scholastic realism amounts to the admission of real laws of nature which have a sort of '*esse in futuro*'. They are the kinds of universals which modern science mostly pays attention to (4.1). They express the reality of what Peirce calls his third category (thirdness), whose main characters lie in its not being reducible to the other two categories (secondness or individual and actual reacting existence, firstness or idiosyncratic possibility), and in its active regulative and legislative power: would-bes are not mere creations of the mind, but real active principles in nature.

Hence, Peirce's extreme scholastic realism claims the reality and irreducibility of all three categories, thus departing from various forms of idealism – like Hegelianism, which finally reduces secondness and firstness to mere figures of thirdness. But it puts a special emphasis on thirdness and firstness, which embody both categories of irreducible indeterminacy, namely generality and vagueness. The original element of Peirce's scholastic realism is in keeping with the Scotistic (and Avicennian) metaphysical intuition. It finds its expression in the two main trends of Peirce's evolutionary metaphysics, namely synechism on the one hand,

the continuity-element or the generalizing tendency to adopt habits; and tychism on the other hand, or the reality of vagueness as may be found in possibility, habit-change, or chance.

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Perception

The nature of sensory perception and its fundamental epistemological role in acquiring knowledge about the existence and properties of the physical world have fascinated philosophers for many centuries. The principal philosophical question about perception has been: 'What is the direct or immediate object of consciousness, when we perceive'. Let us first of all define the concept of direct perception:

P directly perceives $x =_{Df.}$
(1) *P* perceives *x*
(2) It is not the case that *P*'s perception of *x* is mediated by *P*'s perception of an individual *y* which is different from *x*.

We can now distinguish the main theories that have been advocated in the philosophy of perception. *Direct realism* holds that the direct object of perception is always a physical object, an object whose existence is logically independent of our perception of it. Thus direct realism represents the common-sense conception of perception and the external world. For most of us – at least when not theorizing about perception – seem to assume that the world consists in large part of physical objects in space and time that exist continuously and independently of whether or not we perceive them; that are not affected by changes in the normal conditions in which they are perceived; and that have the familiar perceivable properties of colour, form, weight, size, etc. And we also seem to assume that we perceive these objects directly, and that by means of that direct perception we acquire non-inferential knowledge about them and some of their properties.

In contrast to this, *representative* or *indirect realism* and *phenomenalism* claim that the immediate object of perception is always a non-physical or phenomenal object, an object whose existence is logically dependent upon our consciousness of it. These phenomenal entities have variously been called 'sense-data', 'sensa', 'sense-impressions', 'percepts', 'ideas', etc.

Representative realism and phenomenalism disagree, however, with respect to the nature of the physical world. Representative realism asserts that, though we directly perceive only sense-data, there nevertheless exist physical objects which are ontologically quite distinct from sense-data and causally responsible for their existence. Phenomenalism, on the other hand, claims that physical objects are nothing but groups or complexes of sense-data, and so implies that physical objects are not capable of existing independently of our perception.

The Argument from Perceptual Relativity. The question arises, why so many philosophers came to think that the direct object of perception must always be a sense-datum. There are various facts about perception – illusions, hallucinations, the complex causal process from the impinging object to the perceiver's brain, scientific assertions about the nature of the material world, etc. – that philosophers thought could only be explained by introducing sense-data. But above all it was the familiar fact that things sometimes

look different from the way they really are – that the way things appear varies with changes in the position of the perceiver, in lighting conditions, and in the kind of medium between perceiver and things – that became the starting-point for drastic revisions of our ordinary conception of perception and the world. This line of thought crystallized into a classical argument that can be found in the writings of philosophers from antiquity to the present, e.g. in Plato, John Locke, George Berkeley, David Hume, Bertrand Russell, A. J. Ayer (1910–89), G. E. Moore, and C. D. Broad (1887–1971). The argument from perceptual relativity runs as follows:

1. Under certain non-standard conditions things look different from the way they really are. For example, a straight oar with one end in water looks bent.
2. The properties directly perceived under these conditions are properties of something. In our example something must be bent because the perceiver has an instance of bentness immediately present to his consciousness, and bentness is inconceivable without something's being bent.
3. But, *ex hypothesi*, the things which have the properties directly perceived in all these cases – in our example the property of being bent – cannot be identical with the respective physical objects, because we presupposed that the oar is really straight.
4. Therefore the properties directly perceived under non-standard conditions must be properties of non-physical or phenomenal objects. Such objects are called 'sense-data'.
5. If it is the case that we directly perceive sense-data only under non-standard conditions, while under standard conditions we directly perceive physical objects, then there must be a discernible qualitative difference between these two kinds of perception indicating the different ontological status of their respective objects.
6. There is no discernible qualitative difference between perception under standard and under non-standard conditions; on the contrary, non-standard conditions shade imperceptibly into standard conditions.
7. Therefore we always directly perceive only sense-data; under non-standard as well as under standard conditions.

The argument thus has the structure of a *reductio ad absurdum*: starting with the common-sense assumption that we at least sometimes directly perceive physical objects, it tries to derive with the help of certain additional premisses the contradictory of that assumption.

What sorts of things are these sense-data supposed to be? A sense-datum can be defined as a phenomenal or mental individual; that is, an individual that exists when and only when it is being perceived. A free-floating sense-datum, a sense-datum that is not being perceived, is a conceptual impossibility; its *esse* is *percipi*. Hence sense-data are ontologically distinct from physical objects realistically conceived, for it is an essential part of our concept of a physical object, that its existence and nature are logically independent of the fact that it is being perceived; its *esse* is not *percipi*. And this dependence of the existence of sense-data on a perceiver who actually perceives them has the further important consequence that they are private objects. Because sense-data, as it is often put, exist only 'in' the mind of a person, it is impossible that two distinct persons could perceive numerically the same sense-datum. So far there is usually agreement. The more precise metaphysical nature of these entities – a subject of intense debate among supporters of the various forms of the sense-data theory – need not concern us here. We are interested, rather, in the drastic epistemological and metaphysical consequences of the argument. Once it is granted that the only direct objects of perception are sense-data, essentially only two theories of perception and the external world are possible: representative or indirect realism, and phenomenalism.

Representative Realism. This position has been held by many philosophers, for example by Locke, René Descartes, Leibniz, Nicolas

Malebranche, and Russell. In my presentation of the theory I will orient myself around the version given by Locke. Locke was a realist. But he was persuaded by the argument from perceptual relativity, and additionally by certain scientific findings about the nature of the material world, to reject direct realism and to distinguish sharply between sense-data or, as he called them, 'ideas', as direct objects of perception and external physical objects that somehow give rise to and are represented by these sense-data. This distinction seemed to him to open up the possibility of holding that perception of physical objects is indirect perception based on the direct perception of sense-data. He tried, in other words, to characterize the perception of physical objects as the perception of sense-data caused by them.

Let us define what an advocate of representative realism can mean by 'indirect perception':

P indirectly perceives a physical object $x =_{\text{Df.}}$
(1) P directly perceives a sense-datum S
(2) S is caused by x
(3) S represents x.

But Locke himself saw that his epistemological dualism raises a serious problem, the problem namely of how we can know that our sense-data correspond to physical objects if we are always directly presented with sense-data and never with physical objects themselves. He himself anticipated the standard sceptical objection against representative realism – that if we can directly perceive only sense-data, then these sense-data form a barrier or a veil preventing us from acquiring any knowledge about external objects. If we can never break out of the circle of sense-data, how can we know what properties the external objects possess, indeed, how can we even know that there are such objects?

However, Locke was also firmly convinced that he could rebut the objection that his theory leads to epistemological scepticism. He thought he could solve the problem by a causal inference, i.e. an inference from the effects – the sense-data – to their causes – the external physical objects. His thesis was that a person P could justify his belief that he perceives a physical object x by an inference showing that x is causally responsible for certain sense-data which P is directly perceiving. But can a causal inference bridge the logical gap between sense-data and external objects? Causal laws are not logical or analytical truths. It is impossible by means of a careful examination of one event alone to know *a priori* what the cause of this event is. On the basis of our immediate perception of sense-data alone, we have no deductive evidence for the existence of external objects; the existence of sense-data does not logically entail the existence of physical objects. Causal laws are rather synthetic laws *a posteriori*. And thus it must be asked whether our sense-data alone can provide us with non-deductive or inductive reasons sufficient to justify the belief that they are produced by physical objects.

How do we usually establish causal relations between two types of events E_1 and E_2? The answer is that we must discover that each event of the type E_1 is followed by an event of the type E_2. Such a constant correlation between two types of events E_1 and E_2 commonly warrants the claim that E_1 is the cause of E_2. The inductive principle we use in such cases presupposes that we are capable of directly perceiving each member of such a pair of correlated events independently of the other member of the pair. Let us formulate this inductive principle (IP) explicitly: In order to infer inductively from the existence and nature of E_1 to the existence and nature of E_2, or vice versa, it is necessary that we are at least sometimes capable of directly perceiving both E_1 and E_2.

If we now try to apply IP to the pair of events whose members are, on the one hand, a sequence of certain sense-data and, on the other hand, the action of physical objects on our sense organs, it becomes obvious that the one member of the pair of events cannot be ascertained independently of the other member. For according to representative realism it is impossible to know that a certain physical object is acting on our sense organs independently of our direct perception of certain sense-data. Consequently, representative realism cannot rely on IP; for according to it a

constant correlation between the occurrence of certain sense-data and the existence of physical objects must be established for a causal inference from the former to the latter to be justified. This criticism is essentially the standard objection to representative realism; one which Berkeley and David Hume already formulated in their reactions to Locke's philosophical system.

The Hypothetico-Deductive Variant of Representative Realism. The given criticism refutes representative realism only if the advocate of this theory must accept IP. Is our inductive practice really so restricted that any legitimate non-deductive inference must be based on an induction by enumeration, i.e. on a generalization from observed instances? Or is it perhaps a dogma that we can only know that E_1 is the cause of E_2 if we are capable of directly perceiving E_1 as well as E_2? Many examples of our inductive practice are guided by quite another method, the so-called hypothetico-deductive method or inference to the best explanation. According to this method, a hypothesis about unobservable objects can be confirmed in virtue of its explanatory power with respect to certain observable states of affairs; and so, unlike ordinary causal inferences, does not require that the existence of the cause be discoverable independently of the existence of its effect. The way now seems open to the upholder of representative realism to make use of the hypothetico-deductive method, and claim that the hypothesis of a world of external physical objects is the best explanation of certain characteristics and regularities of our sense-data.

The underlying thought, here, is that the relation between sentences about sense-data and sentences about ordinary physical objects can be assimilated to the relation between observation sentences and theoretical sentences on a certain traditional account of theories, according to which the relationship between a theory and its observation basis can be expressed by four kinds of sentences: theoretical sentences, correspondence rules, observation generalizations, and singular observation sentences. On this account, one is to explain why an observable object a, which has the property F, also has the property G, by invoking the observation generalization $(\forall x)(Fx \rightarrow Gx)$ which can be derived via correspondence rules from the theory. In order to test the explanatory power of the theory, however, at least some of the generalized observation sentences that are explained by the theory must be inductively confirmed independently of the theory. This is the crucial point. For if we transfer this explanatory model to the relation of the framework of sense-data to the framework of physical objects we must assume that there are sense-data generalizations which are inductively confirmable independently of the 'theory' of physical objects. The problem is that we have good reasons for believing that there are no such sense-data generalizations. The generalizations usually offered have the following form: if a person is in such and such objective conditions of perception, then, given the direct perception of a sense-datum S_1, he can predict the direct perception of a sense-datum S_2. However, this is not the kind of order within experience that the believer in independent sense-data generalizations needs, for he must show that the whole fabric of empirical knowledge, and hence also the physical and physiological conditions of a given perceptual situation, can be inferred from a set of premisses exclusively about sense-data. Sense-data generalizations tend to be impure; they do not seem to be formulable without help from the framework of physical objects and perceivers. True and open generalizations about the course of experience are dependent generalizations; that is, they depend upon our common-sense assumptions about ourselves, about our status as observers, about our sense organs, and about the specific physical conditions of a given perceptual situation that are embodied in the conceptual framework of physical objects in space and time. There simply seems to be no way to formulate the evidence for the 'theory' of physical objects, its data, in a manner that does not already somehow make use of this 'theory'. And so there seem to be conclusive reasons against the hypothetico-deductive variant of representative realism too.

Phenomenalism. Ontological Phenomenalism. Let us now turn our attention to

the traditional alternative to representative realism: ontological phenomenalism. In the history of philosophy Berkeley was doubtless its most illustrious champion. Berkeley was convinced that Locke's representative realism leads to epistemological scepticism. His own answer to the problem of scepticism was strikingly simple. He believed he could solve it by an ontological reduction. If the root of scepticism is the distinction between physical objects and sense-data, then to undermine scepticism we need only identify physical objects with sense-data.

The fundamental thesis of Berkeley's ontological phenomenalism can be put as follows:

OP: A physical object is identical with a complex of sense-data.

Berkeley agrees with Locke that the only direct objects of perception are sense-data. But he does not accept the thesis that these sense-data represent and are caused by external objects. If a physical object is identical with a group of sense-data, then the relation between the perception of a certain set of sense-data and the perception of a physical object is not contingent, as in representative realism, but necessary. Our claims to perceive physical objects can be justified deductively from premisses about sense-data. Thus the theory seems to have clear epistemological advantages over representative realism. But the question arises whether these advantages have not been purchased at too high a price, namely implausible ontological consequences.

One well-known objection is that ontological phenomenalism implies that physical objects are not publicly or intersubjectively observable: if the only objects we can perceive are our own private sense-data, then phenomenalism's commitment to physical objects being nothing but groups of sense-data leads to the consequence that different persons can never perceive the same physical object. The only way that holds any promise for phenomenalism is to concede that the complex of sense-data which is identical with an object includes the sense-data of different perceivers. It could then be said that two persons P_1 and P_2 perceive the same physical object x when and only when the sense-data which P_1 perceives and the sense-data which P_2 perceives belong to the group of sense-data that is identical with x. But even this strategy is unsatisfactory, since it still implies that the elements out of which a physical object is composed, the sense-data, are not perceivable by different persons, and it is hardly believable that physical objects consist of such private elements.

Another familiar objection to ontological phenomenalism is that it has the absurd consequence that physical objects exist discontinuously, that they constantly jump into and out of existence. Sense-data are short-lived entities; they exist only when and as long as they are being perceived. Hence, since a physical object is nothing but a complex of sense-data, it follows that it ceases to exist when nobody perceives it, and begins to exist anew when somebody perceives it again at a later time. But surely this is an extremely implausible result, for physical objects exist continuously while they are not being perceived by anybody. Berkeley anticipated this objection and replied that the groups of sense-data that are identical with physical objects exist continuously even when not being perceived by a finite being because they are continuously being perceived by an infinite being, namely God.

It remained to John Stuart Mill (1806–73) in *An Examination of Sir William Hamilton's Philosophy* (London, 1865, Volume 1) – to present a version of ontological phenomenalism that is independent of any assumptions about the existence of God. His essential innovation was the introduction of the concept of a possible sense-datum. A possible sense-datum is simply a sense-datum that could be perceived under certain conditions of perception. Let us formulate Mill's version of ontological phenomenalism:

OP′: A physical object is identical with a complex of actual and possible sense-data.

The possible sense-data take over the function of Berkeley's *deus ex machina* as guarantors of the existence of unperceived objects. For even if no actual sense-data of a given

physical object exist at this moment – because nobody is perceiving it – we can still say, according to Mill, that *if* anybody were to look at it, he would perceive sense-data belonging to it. But a physical object, during intervals of time when nobody is perceiving it, consists of possible sense-data and nothing else. And these possible sense-data clearly dominate the actual sense-data in Mill's theory of the material world, for at any given time only a relatively small part of the material world is being perceived. The uninhabited regions of the Earth's surface, subterranean matter, and distant stars consist of merely possible sense-data that may never become actual because it may be that nobody ever actually perceives them. Mill's theory thus seems to deprive physical objects of their categorical status and to concede to them a merely hypothetical status as unfulfilled possibilities. But, since merely possible existence is a mode of non-existence, this theory embodies an absurd conception of physical reality. It implies, amongst other things, that an existent physical object can consist of non-existent components and that whenever a certain event is being perceived, without its cause also being perceived, a mere possibility gives rise to an actual effect.

Is there another way for phenomenalism to close the gaps between actual sense-data? In his paper "The Relation of Sense-Data to Physics" (in *Mysticism and Logic*, New York, 1914), the early Bertrand Russell made an unorthodox proposal. The problem of the continuous existence of physical objects becomes solvable, he claimed, if it is granted that sense-data continue to exist even when we are no longer perceiving them. They are then called 'sensibilia', the term 'sense-data' being reserved for those sensibilia that are presently being perceived. Let us express Russell's position in a single thesis as well.

OP″: A physical object is identical with a complex of sensibilia. Some of these sensibilia are perceived from time to time and are then called 'sense-data'.

But how can it be known that sense-data continue to exist as unperceived sensibilia? Surely not on the basis of sensory perception, for it is logically impossible to perceive that anything continues to exist unperceived. Russell conceded that they are hypothetical entities. They are postulated to reconcile the discontinuity of sensory experience with the continuous existence of the physical world. But as hypothetical entities sensibilia are at least as obscure as the strictly unperceivable external objects of representative realism, and indeed they introduce the very problems which they were intended to avoid.

Analytical Phenomenalism. With his *The Foundations of Empirical Knowledge* (London, 1940), A. J. Ayer initiated a new phase of the phenomenalistic movement: analytical phenomenalism. Its main difference from ontological phenomenalism lies in its linguistic orientation. The introduction of the concept of a sense-datum, Ayer urges, does not involve the introduction of a special kind of object; rather it involves merely a new terminology that helps the epistemologist to identify in a metaphysically neutral way the common descriptive core in veridical perceptions and phenomenologically indistinguishable sensory experiences under non-standard conditions. Accordingly, physical objects do not literally consist of sense-data, but are logical constructions of them; that is, sentences which refer to physical objects could also be expressed by or reduced to sentences which referred exclusively to sense-data.

In the wake of Ayer's discussion, the claim that sentences about physical objects can be reduced to sentences about sense-data came to be understood as the claim that the relationship between these two classes of sentences is a relationship of logical equivalence, i.e., that a certain set of sentences about sense-data entails a sentence about a physical object, and vice versa that a given sentence about a physical object entails a set of sentences about sense-data. It is obvious that one can falsify a logical equivalence by falsifying either one or both of its constituent entailments. But the epistemologically essential entailment for one who wishes to refute the sceptic is the entailment from sets of sentences about sense-data to sentences about physical objects. Let us examine this entailment, taking the following sentence as our analysandum:

(A) This is a red rose.

Let us now propose the following plausible phenomenalistic analysans:

(B) If a normal perceiver were to perceive a sense-datum here and now, he would perceive a sense-datum of a red rose.

Does (B) entail (A)? A simple logical strategy for showing that one sentence does not entail another is to find a third sentence consistent with the first, and which, in conjunction with the first, does not entail the second. Hence, to reject the proposed analysis, we must find a third sentence (C), which is consistent with (B), and which, when conjoined with (B), does not entail (A). An example of such a sentence is the following:

(C) This is a perfect imitation of a red rose.

(B) and (C) do not entail (A), and so (B) does not entail (A). And, however one may try to improve (B), there is simply no possibility of avoiding counterexamples of the given sort. Logical possibilities are difficult to exclude; for example, Descartes's evil demon might systematically deceive us, and cause sense-data of red roses in us, although there are no red roses here or anywhere else.

Direct Realism. Once a version of the sense-data theory is accepted, only two philosophical theories of perception remain, representative realism and phenomenalism. The failure of these two theories therefore led philosophers to abandon sense-data theories and their central assumption that the only objects we immediately perceive are sense-data. Many philosophers, such as Thomas Reid already in the 18th century, and R. M. Chisholm, D. M. Armstrong, and G. Pitcher in more recent times, began to claim that direct realism is the most plausible theory of perception from an epistemological and metaphysical point of view. We characterized direct realism initially as the view that the direct objects of perception are physical objects. This position can best be understood by contrasting it to representative realism, for it maintains what the latter theory denies. The direct realist denies that in perceiving a physical object x one is immediately aware of a non-physical object y that mediates the perception of x. Instead, perception is a direct awareness of physical objects, i.e. their existence and nature are not inferred on the basis of a direct apprehension of sense-data.

Of course, direct realism need not deny that in certain perceptual situations we may acquire inferential knowledge about the physical world. For example, we can infer that a pullover is blue, because it looks green under electric light. But what direct realists will insist on, is that we do not always draw such inferences when we believe we are perceiving physical objects, but that, on the contrary, we mostly acquire perceptual knowledge about physical reality non-inferentially. Direct realism therefore presents itself as a refutation of that kind of epistemological scepticism whose point of departure is the thesis that the only direct objects of consciousness, when we perceive, are sense-data.

The Argument from Perceptual Relativity Reconsidered. But direct realism still owes us an answer to the argument from perceptual relativity. Its first premiss – that under certain non-standard conditions things look different from the way they really are – is, even for the direct realist, uncontroversial. The second premiss is:

2. The properties directly perceived under these conditions are properties of something.

2. is phenomenologically very plausible. Is it not obvious that, if under electric light a blue skirt looks green to me, something green is immediately before my consciousness? And, over and above my direct awareness of an instance of greenness, is it not the best explanation of how I know that the skirt looks green and not, for example, red or brown or white, that I directly perceive something green? But in spite of its phenomenological plausibility, 2. is the crux of the argument. For, in order to get from 1. to 2. something like the following principle (P) is needed.

> If something x looks F to a person, but is not really F, then something else, y, which is different from x, really is F, and is being directly perceived by that person.

(P) is a tacit, but crucial premiss of the argument. (P), once identified, is hardly plausible. If a person looks dead to me, but is not really dead, does it follow that something else, a sense-datum, really is dead? Or, if an animal looks like a unicorn, but is not a unicorn, does it follow that something else really is a unicorn? The list of such absurdities could be lengthened at will. (P) must be rejected. Hence, the passage from 1. to 2. is illegitimate, and the argument from perceptual relativity fails. What a direct realist will say, regarding our original example, is that if a straight oar with one end in water looks bent, then the only object we perceive is the oar, which under such special conditions simply looks bent. We see no object which really is bent.

Many philosophers thought they could leave it at that. They saw no need for a positive philosophical theory about the nature of sensory experience. Indeed, after the failure of the sense-data theory, they tried to avoid talking about sensory experience altogether. But unsatisfactory theories about the phenomena must not lead us to ignore the phenomena themselves.

Though the argument from perceptual relativity does not succeed in proving what it was intended to prove, it does succeed in so far as it attempts to identify sensory experiences and their phenomenological content by appealing to cases of perception under unusual conditions. Another, perhaps even more effective way of accomplishing this, is by appealing to hallucinations. When a person hallucinates, he may have sensory experiences which are phenomenologically indistinguishable from veridical perceptual experiences, although there is no physical object which is perceived by him. So in such cases, the phenomenological core of experience must be identified independently of any reference to physical objects, and this invalidates the direct realists' thesis that all the various kinds of sensory experiences involve some physical object's looking or appearing to us in a certain way. But how then are the various kinds of sensory experiences and their characteristic uniformity and homogeneity to be positively specified?

The Adverbial Analysis of Sensory Experience. The so-called adverbial analysis of experience, anticipated by Thomas Reid and developed by C. J. Ducasse, R. M. Chisholm, W. Sellars, and J. Cornman, is best understood as a rival to the classical sense-data theory. According to the adverbial analysis, having a sensory experience is not to be equated with a direct awareness of a special non-physical object, but rather with being in a mental state of a certain kind, a mental state of sensing in a certain way. The adverbial theory utilizes the fact that sense-data are conceived as entities which exist when and only when they are being perceived in order to paraphrase sentences which seem to refer to such phenomenal objects as sentences about the specific manner in which a certain person senses. The adverbial theory relies on the familiar point that grammatical form and logical form need not coincide, and holds that the correct analysis of:

(A) P has a sense-datum of a red square

is not a relational analysis along the lines of:

(B) $(\exists x)$ $(\exists y)$ (x is the person P, and y is a red and square sense-datum, and x has y)

but rather a non-relational analysis of the form:

(C) $(\exists x)$ (x is the person P, and x senses a-red-square-ly).

An expression such as 'a-red-square-ly' functions as an adverb and characterizes the specific manner in which a person senses. When a person senses a-red-square-ly, he is in a sensory state of a certain kind, a kind that in normal perceivers and under normal conditions is produced by their perceiving red and square physical objects, but a kind that may, under non-standard conditions, be produced also by different causal antecedents. Thus, the main advantage of the adverbial

theory is that it can cope with cases of perceptual relativity and with hallucinations, and so can explain the uniformity and homogeneity of all kinds of sensory experience. According to the adverbial analysis, what should be said about the example of a blue skirt's looking green to P under electric light, is that P senses greenly with respect to the blue skirt. And what should be said about Macbeth who has a hallucinatory experience of a dagger is that Macbeth senses a-daggerly. When a person senses a-dagger-ly he is not necessarily in a state caused by a dagger stimulating his visual receptors, but he is in a state of a certain kind, one which under normal conditions is indeed caused by a real physical dagger, but which also, when a person hallucinates, is produced by quite another causal chain. The adverbial sensing terminology thus casts light on the fact that to have a hallucination of a dagger is not to be related to a peculiar phenomenal object, but to be in a non-relational subjective state; it is not to sense an object, but to sense in a particular objectless way.

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RICHARD SCHANTZ

Persons

There is little agreement about what persons are. This situation may reflect conceptual confusion or indeterminacy, or it may reveal that there is still scope for developing a satisfactory account of the person. The term 'person' has a history of special use in legal and theological contexts. Apart from these, the term is often synonymous with 'human being'. The history of thought about persons is thus linked to changing legal, social, and theological trends as well as to more general reflection on the nature of the human subject, the 'I' that thinks, feels, reflects on itself and its doings, and carries responsibility for its previous actions.

Some of the puzzles in this area can be traced back deep into the history of philosophy, while others – like those concerning personal identity – have only surfaced since the Renaissance. The problem of personal identity resolves into two different questions, one concerning the unity of the self at a time, and the other dealing with unity through time. In tackling the latter issue, theorists are divided in the weight they give to psychological conditions, such as memory, and to physical conditions for unity (e.g. sameness of brain or body).

Persons as Centres of Consciousness. Cartesian dualism encapsulates a tradition of regarding the human subject as essentially a conscious being, where the consciousness in question is of a special, *reflexive* kind. Although Boethius and the medievals articulated such a conception, it was John Locke and the other 17th-century writers who brought to prominence the reflexive nature of human thinking. As Locke writes,

> it is by the consciousness it has of its present thoughts and actions that it is *self* to *self* now, and so will be the same self as far as the same consciousness can extend to actions past or to come (*Essay*, 2nd ed., 1694, Book II, Chapter 27).

Locke, like Leibniz, reflects the emerging liberal conception of the individual, as the focus not only of special states of mind, but also the carrier of merit and blame and the holder of rights. According to Locke, amnesia destroys moral responsibility by destroying the continuity of reflexive consciousness. Moreover, he maintained that a single centre of consciousness could persist through a change of bodies, as in his famous fantasy where the soul of a prince is imagined to 'enter and inform' the body of a cobbler. Locke's view need not imply the possibility of disembodied existence, but in the 17th and 18th centuries it was generally supposed that persons are non-physical items normally embodied in human form.

This tendency in theorizing about persons to prescind from both the physical facts of bodily existence and also the social location of human beings in their communities gave a special status to the individual, whether as an autonomous self-chooser and self-creator (in the philosophy of Kant) or as the possessor of a web of complex desires (in the 19th-century utilitarian and liberal theories of Jeremy Bentham (1748–1832) and John Stuart Mill (1806–73)). It can be argued that the emergence of a peculiarly European, liberal conception of the self as one centre of values surrounded by other, equally valuable selves, was abetted by René Descartes's dualist separation of the mental from the physical.

A version of Locke's view survives currently in the work of writers like David Wiggins and Derek Parfit. Their accounts emphasize the importance of memory and other high-level features (involving self-consciousness) to the unity of the person. Such accounts run the risk of placing implausibly stringent demands on personal unity. Amnesics and other psychologically impaired subjects are ruled out from the class of persons. Bernard Williams has, by contrast, argued that we must recognize the 'deeply body-based' situation of persons.

In raising radical doubts about the continuity of a single self across the typical human lifespan, Parfit has prompted serious moral questions (about, for example, the limits of our accountability and responsibility). David Hume, a much earlier source of scepticism about the unity of our lives, suggested famously that since we can obtain no enduring impression of the self, persons are no more than 'bundles' of perceptions. The source of unity for such bundles, whether at a given time or through time, remains, on Hume's account, entirely mysterious.

Moral Standing. Lockean and neo-Lockean accounts mesh well with the perspective on persons as items of unconditional moral worth. A central statement of such a perspective is found in Kant, who portrays the human self as autonomous, the possessor of rights, and the paradigm of a being which has interests of the sort that can be represented in legal proceedings and moral deliberations. The special moral status of persons in Kant's critical philosophy involves prohibiting their use solely as the means to the ends of other agents, and also represents them as beings who voluntarily place themselves under the restraint of the moral law.

The Kantian conception of the self is important for understanding subsequent European, and American, thought on human rights, and the emergence of recent theories on the nature of the social contract drawing on the tradition of Locke, Jean-Jacques Rousseau (1712–78), and Kant (see, e.g., Rawls 1972). The transcendental and idealist elements in the Kantian perspective gave rise to a separate tradition culminating in Hegel's absolute idealism in which finite persons are supposed to be absorbed into something (the absolute) which transcends individuals. By contrast, *personalists* draw upon the idealism found in George Berkeley to maintain that persons, or elements in their experiences, are the only things that are real.

The reflexive consciousness and rationality of persons provides one way of grounding the claims that persons are unique and unrepeatable. But other conceptions of the person seem to require less by way of underpinning by a dualist metaphysic. For example, Marxists maintain that persons are items located in history, whose nature is to engage in creative transformation of the world by their labour. Although this view regards persons as to an extent the product of historical and social forces, it may still motivate a special moral concern for them, and also a concern for the

social forces that are involved in self-creation.

Jean-Paul Sartre's (1905–80) existentialism, by contrast, focuses on the ability of agents to choose their own projects, and has emphasized the failure of many people to exploit the potential for freedom that they possess. Few philosophers have noted that, in addition to the impact of external forces and social location, the project of self-creation can be regarded as having both a deliberate and an accidental aspect (but see Glover 1988). Freudian psychoanalysis adds a layer of largely hidden, but causally significant, influences on the subject's actions. In the work of J. Lacan, tensions within the self are related to the individual's participation in larger symbolic structures such as language and kin relations.

Problems of the Self. No theorist in the recent analytic tradition has argued convincingly that wherever we find a living human body we will also find a person. Although there is wide recognition that persons are both subjects with physical and psychological features and also the focus of agency, there is still disagreement over the relative merits of body- and memory-based accounts of unity.

The dominant metaphysical traditions are of little help in clarifying a further, puzzling issue. Persons may be viewed (in the liberal tradition) as unique possessors of inherent values which they transmit, so to speak, to those activities in which they engage. On the other hand, they may be viewed as knots in a web of social, cultural, and even ecological relations, inheriting such value as they possess from the surrounding context. Without some *rapprochement* between these different perspectives, it is hard to see how any delineation of the concept of a person can do justice to the multiplicity of views we hold about ourselves.

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ANDREW A. BRENNAN

Peter Abelard

Peter Abelard, who in the first half of the 12th century was the most celebrated teacher of logic and theology in Western Europe, was born in 1079 of a minor noble family at Le Pallet near Nantes in Brittany. His first teacher (*c.* 1094) was the notorious Roscelin (*c.* 1045–1120), famous for his view that the subject matter of logic was vocal utterances (*voces*) and that in particular all universals are mere vocal utterances, and for his alleged 'tri-theism', the heresy he was led to by his treatment of the Trinity. The positions Abelard later took on both universals and the Trinity were probably much influenced by the ideas of his first teacher, although understandably Abelard himself never acknowledged such a debt to a condemned heretic.

Early in the 12th century Abelard moved to Paris and studied logic and theology there under William of Champeaux (*c.* 1070–1120). The relationship was stormy and ended with Abelard forcing William to withdraw from his realist theory of universals. In 1104 Abelard set up his own school at Melun. A few years later he was back in Paris at Mont Ste. Geneviève as a very popular teacher attracting students away from his old master William.

Realizing that he needed further training in theology if he was to teach in that area as well as in logic, Abelard took up studies with Anselm of Laon, but again he soon found himself competing with his teacher as much as learning from him. By 1116 he was back at Mont Ste. Geneviève.

It was at this point in his career (1118) that Abelard met Heloise and their celebrated love affair ensued. After the birth of a son they married secretly, but Heloise's uncle and guardian let the news out, and Abelard felt impelled to place Heloise in a convent. The uncle was so enraged at what he perceived to be Abelard's desertion of his niece

that he hired thugs who proceeded to castrate her famous husband. Heloise went on to become a nun and have a significant career of her own in the Church. Abelard retired for a while to the abbey of St. Denis, but it was not long before he was teaching again and attracting pupils from all over Europe.

Abelard, whose belligerent personality had earned him enemies in high ecclesiastical places, now found his views on the Trinity under attack, and eventually they were condemned by a council in Soissons in 1121. Our scholar fled to the countryside, but his students followed and soon he was teaching again in buildings he and his students erected near Quincey. Later (1125) he was made an abbot of a monastery in Brittany, but this was a disaster. The depraved monks there were not willing to accept Abelard's discipline, and he was forced to flee (*c.* 1131).

Toward the end of his life Abelard once again taught on Mont Ste. Geneviève and again found himself the object of ecclesiastical displeasure, especially with his Trinitarian views, this time from no less a figure than the formidable Bernard of Clairvaux (*c.* 1090–1153). After some of these doctrines were condemned by the Council of Sens in 1142, Abelard intended to make a personal appeal to the Pope, but ill health intervened and Abelard had to rely on Peter the Venerable to arrange a reconciliation between himself and Bernard. Abelard died shortly afterwards on 21 April 1142.

Abelard's ontological and metaphysical doctrines can be found scattered through his logical and theological works. There is considerable uncertainty as to the dates of many of these and the problem is exacerbated by Abelard's having revised some of them extensively quite a while after they were first produced. In logic his two main works are his *Dialectica* and his *Logica ingredientibus*. The former contains a subtle discussion of the ontological status of *dicta*, i.e. the primary bearers of truth and falsity (de Rijk 1970, pp. 154–60); the latter also discusses *dicta* (Geyer 1919–27, pp. 365–70), as well as providing Abelard's most extensive discussion of universals, in which he attacks various forms of realism and defends the 'nominalist' view that universals are vocal utterances (Geyer 1919–27, pp. 8–32). Another logic, the *Logica 'Nostrorum petitioni sociorum'* has a significantly different view on universals (Geyer 1919–27, pp. 522–33). The function of the verb 'to be' used as a copula is treated in both the *Dialectica* (de Rijk 1970, pp. 130–2) and the *Logica ingredientibus* (Geyer 1919–27, pp. 339–40, 362).

In theology Abelard's most important work so far as ontology is concerned is his *Theologia Christiana*, which contains an extended discussion of sameness and diversity (Buytaert 1969, pp. 219–318) in the context of defending the dogma of the Trinity. We also find a statement of Abelard's view that *status*, i.e. the properties signified by predicates, are not things, neither substances nor forms (Buytaert 1969, pp. 256–7, 342–4), and an interesting remark on existence statements having abstract nouns as subjects (Buytaert 1969, pp. 343–4).

In ontology Abelard's most original views concern *status* and *dicta*, on the one hand, and identity and diversity on the other. With regard to the former, his somewhat paradoxical view is that they are objective even though they are no sort of thing. In general, Abelard assumes an ontology of two basic sorts of things: substances, and forms that exist only by inhering in substances. *Status* and *dicta* fall into neither of these classes. As for identity and diversity, he basically distinguishes 'identity in essence' from identity in property or definition. Identity of the first sort requires total coincidence of underlying substance; identity of the second sort is stronger and requires sameness of defining property as well.

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MARTIN TWEEDALE

Peter Aureoli

Peter Aureoli, O. F. M. (probably born in Cahors 1275/80 and died in Aix 1322) lectured on the *Sentences* – the theological handbook compiled about 1158 by Peter Lombard (*c.* 1100–1164) – between 1312 and 1318 at Bologna, Toulouse, and Paris. Together with Durandus of Saint-Pourçain (*c.* 1275–1334), he made an important contribution to the development of the notion of *esse apparens* or apparent being, as opposed to *esse reale* or real being.

Starting from a description of eight instances of aberrant perception, such as seeing a stick that is partly submerged in water as bent, double vision, and having after-images, he concludes that these experiences can be explained only by the hypothesis that what is seen has merely apparent being. Moreover, he is of the opinion that this production of apparent being is not restricted to erroneous vision, but occurs also in veridical forms of sense-perception and in intellectual conception. According to him, an act of conceiving is an operation of the intellect that makes something appear to the mind. It is logically necessary that to this activity of thinking there corresponds something that is thought. Just as someone cannot be a father without having a child, so one cannot think without thinking something in which the act terminates as in an internal object.

The formative act of conceiving has an immanent product whose being can be characterized as an appearing to the mind, or, as Peter also puts it, as a mode of being that consists in *esse conceptum*, *intentionale*, or *obiectivum*. Such a mode of being is typical of that which is passively thought of in an intellectual conception and is thus presented to the mind. A thing thought of is a *conceptus obiectivus* in so far as it is put before the mind and so has a special, intentional mode of being. This is a weak form of existence in as much as one cannot infer from it that the thing in question exists really and independently of the mental act whose termination it is.

The various expressions Aureoli uses for this special kind of existence (also *esse cognitum*, *esse conspicuum*, *esse intellectum*) have in common that they indicate a form of being which is contrasted with the real existence of the act of thinking and of things in the world outside the mind. An act of conceiving is deceptive or false if the thing conceived of has only this weak form of being, that is, if nothing corresponds to it in the world of real existents. On the other hand, the act is veridical or true if the thing as it is conceived of and put before the mind is identical to the thing as it really exists in the outside world. In the case of correct conceptions the object of the act of conceiving is one and the same thing having two different but concordant modes of being: the way it is conceived of and appears to the mind agrees with the way in which it really exists in the extramental world. One of the reasons why Aureoli feels entitled to posit passive objects having apparent being is the fact that there is a plurality of active conceptions by which one and the same thing may be put before the mind. If the diversity of active conceptions has a correlate on the part of the object, this corresponding diversity cannot reside in the thing as such, since that remains one and the same, but must be ascribed to the thing as it is conceived of and appears to the mind.

Peter Aureoli's elaboration of the notion of apparent being has been very influential in establishing the distinction between the kind of real existence that belongs to the cognitive act as such and to the intended things in the extramental world and, on the other hand,

the form of being that consists precisely in being the immanent object of an act of thinking.

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GABRIEL NUCHELMANS

Peter Ramus. See: Ramus

Pfänder, Alexander

Alexander Pfänder was born in Iserlohn in 1870. From 1891 he studied in Munich, where he was to remain for the rest of his life. He was a leading figure among the students of Theodor Lipps, under whom he took his habilitation with his work *The Phenomenology of Willing* (1900; 3rd edition, Munich, 1963). In this work – as he was later to claim – he developed a phenomenology independently of Edmund Husserl. Only after Husserl's visit to Munich in 1904 and under the impulse of Johannes Daubert, did Pfänder study Husserl's *Logical Investigations*, and in fact Pfänder became, next to Husserl, the first professor to teach phenomenology at a German university. Pfänder died in 1941.

Pfänder's interest centres around psychology. The facts of psychic life are, he holds, obvious to everybody. Hence psychology must not seek to discover what is new and unheard-of. Rather, it has faithfully to describe what is given, in part by constantly referring to the psychological insights contained in ordinary language. Psychic life is a temporal flux united by a numerically identical ego. Yet one may more or less adequately distinguish between three sorts of consciousness: consciousness of objects; feelings; and strivings.

The fundamental type of object-directed consciousness is sensation, i.e. the subject's relation to the world of material objects. Sensation is to this extent restricted in its objects. The realm of what Pfänder calls presentations (*Vorstellungen*), in contrast, is unlimited; the latter includes all kinds of imagination. Presentations refer to objects that are absent, yet they are distinct from memories, since memory imputes to its objects strict temporal links to what is currently given in sensation. Perception is a complex consisting of sensations and presentations of various types: one always perceives more than one sees.

Striving (*Streben*) in the general sense of the term is always bound up with a presentation of the object striven for. Objects of striving are marked by acts of attention which throw them into relief with regard to other presented contents. In addition they are presented as the goal of spontaneous feelings of sympathy. That specific type of striving which we call willing is usually expressed in practical sentences (having a characteristic logical structure) of the type 'I want *P*'; these are not reducible to general theoretical assertions of the type '*S* wants *P*'. Willing presupposes further the conviction of being able to realize by one's own means what one strives for, i.e. it extends not only to the goal of willing, but also to the conditions of its realization. And it presupposes finally that at least the first member of this realization is presented as pertaining to the sphere of one's free activities.

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KARL SCHUHMANN

Phenomenology

The term 'phenomenology' (from the Greek φαινόμενον = appearance) originated in the early 18th century. Its use was, however, foreshadowed in the 16th and 17th centuries when the scepticism of Sextus Empiricus (*c.* 150–*c.* 225) and Aratos's (3rd century BC) astronomical, descriptive poem *Phainomena* (*c.* 270 BC) became popular. Phenomenological method in fact began with the remark of Copernicus's pupil Georg J. Rhetikus (1514–74) to the effect "that astronomy be free of hypotheses, I shall be satisfied with only observations" (K. H. Burmeister, *Georg Joachim Rhetikus 1514–74*, Wiesbaden, 1967f.).

Francis Bacon (1561–1626) planned as part of his *Instauratio magna* a '*Phaenomena Universi*', which was meant to be a comprehensive inventory and strictly unbiased description of all phenomena, both physical and psychical. Pierre Gassendi, too, following both Sextus Empiricus and Bacon, proposed in 1641 a science, "which I like to call *toon phainomenon*, or historical" (*Opera omnia*, VI). This proposal actually implies that phenomenology is the only possible scientific project, since for Gassendi real, 'intimate' knowledge of the world is reserved to God as its creator.

A third predecessor of phenomenological method was Sir Isaac Newton. As appears from the '*Scholium Generale*' and the '*Regulae philosophandi*' in his *Principia* the later Newton abhorred hypotheses. Only the immediately observable phenomena can found 'experimental philosophy' and all conclusions founded on 'occult qualities', on a reality beyond immediate observation, are speculation or hypothesis.

18th Century. Although Johann Heinrich Lambert (1728–77) is normally credited with having introduced the term 'phenomenology' into Western thought, it was in fact applied much earlier by the Swabian Pietist theosophist Christoph Friedrich Oetinger (1702–82). In an unpublished diary of 1736, principally on the criteria and warrants for certain knowledge, he uses the term 'phenomenology' for the very first time, defining it as a "divine science of relations", i.e. of relations between the things on the surface of the visible world, not between things and their hidden causes. He hereby rejects Leibniz's geometrical method, but accepts his *calculus situs*, which aims at calculating the relative position or situation of unknown objects, starting from given situations of points, lines, and objects: '*Calculus situs est pha[i]nomenologia*', Oetinger writes. In his *Philosophie der Alten* (1762) Oetinger agrees with Gassendi in asserting that phenomenologists "should content themselves with knowing phenomenologically the proximate causes by the most distinct signs, the rest they should leave to heaven". Human knowledge is nothing but "a knowledge of appearance (*Schein*), a phenomenological" knowledge (*Swedenborgs und anderer irdische und himmlische Philosophie*, 1765). In Oetinger's eyes Hippocrates (*c.* 460–*c.* 377 BC), Jakob Boehme (1575–1624), Newton, and the Italian physician George Baglivi (1668–1707) were phenomenologists in this sense.

'Appearance' or 'apparent truth' is the heart of Lambert's phenomenology, which he defines as "theory of appearance" or "transcendent optics and (theory of) perspective" (*Neues Organon*, 1764). It should give methods to reveal distorting factors in appearances and thus "penetrate the truth". In this sense Lambert distinguished sensorial, psychological, and moral 'appearance' and, separately, 'verisimilitude'. Phenomenology determines "what in every kind of appearance is real and true", and thereby reveals "the particular causes and factors" producing and changing those appearances, "in order that one may conclude from appearance to the real and true" and vice versa. His ultimate objective was to make phenomenology a more adequate foundation for metaphysics.

Possibly under Lambert's influence the term was then introduced into England in 1797 by John Robison (1739–1805), who defined it in a Baconian way as purely descriptive "philosophic [natural] history", opposed to "aitiology" and illustrated by Newton's *Optics*. (See the article "Philosophy", *Encyclopaedia Britannica*, 3rd edition.)

Kant, certainly, was influenced by Lambert when he wrote to him in a letter of

1770 about a "*phaenomologia generalis*". Two years later, in a letter to a mutual friend, he mentioned a "phenomology in general" as the first section of Part II of what later became the first *Critique*. Full use of the term was made in the last part of his *Metaphysical Foundations of Natural Science* (1786), where it is defined as determining matter's "motion and rest merely in relation to the way of representation, or *modality*, thus as phenomenon of the external senses".

Among the early followers of Kant it was the Austrian Karl Leonhard Reinhold (1757–1823) who took over the term as meaning "analysis *of nature* as such" (*Beyträge zur leichtern Übersicht des Zustandes der Philosophie*, 1802). Jakob Friedrich Fries (1773–1843), in *Die mathematische Naturphilosophie* (1822), used the term 'phenomenology' to designate a "theory of the *phenomenon of movements*". Johann Gottlieb Fichte, in his *Wissenschaftslehre* of 1804, saw it as a "theory of phenomenon and appearance", and in his *Sittenlehre* (1812) spoke of a "phenomenology of the ego".

Medicine. Phenomenology was probably introduced into medical pathology as early as 1782 by the Kantian-Lambertian physician Markus Herz (1747–1803). In his *Grundriß aller medicinischen Wissenschaften* (1782), Herz defined it as "the natural history of the unnatural changes of the body" (p. 232), opposing it to aetiology, i.e. the knowledge of causes of disease. Christian Gottlieb Selle (1748–1800) followed him in his *Studium physico-medicum* (1787), degrading it to "in fact nothing else but the terminology of nosology [= pathology]" and equating it with symptomatology.

When medicine turned away from empiricism to apriorism in the period 1790–1800, Kant's influence became more dominant along with romantic ideas derived from F. W. J. Schelling (1775–1854). Thus Johann Christian Goldbeck (1775–1831), in his *Grundlinien der Organischen Natur und Organischen Medicin* (1806), adopted a phenomenology as first part of his "organography of man", while Robert K. Küttner (1809–86), in his *Medicinische Phaenomenologie* (2nd edition, 1842), defined it as a "*medical theory of phenomenon* resulting from a larger whole of single observations and empirical judgements gathered from them". In this way empiricism in fact returned to medicine in the shape of phenomenology.

Hegel and Hegelians. Hegel's novel use of the word (possibly inspired by Reinhold) in the title of his *Phänomenologie des Geistes* (1807) reflects no well-defined concept, although it was characterized by him as "science of the *experience of consciousness*" and also as a "becoming-to-be of *science as such* or of *knowledge*". Phenomenology in this sense relates to the evolution from sensual certainty to absolute knowledge in individual and general history. Hegel was thus the first to give phenomenology an evolutionary historical dynamic sense ("Appearance is the arising and passing away, that does not itself arise and pass away, but is 'in itself' and constitutes the actuality and the movement of the life of truth").

A major problem for the Hegelians was the exact relation of Hegel's phenomenology to his system and especially to its 'first' part, the *Logik* of 1812. Both left and right Hegelians gave phenomenology a prominent place in their thought. This occurred first of all in philosophical disciplines like logic: Karl Rosenkranz (1805–79); epistemology: Samuel Grubbe (1786–1853) – see his *Fenomenologi eller Om den sinliga Erfarenheten*; metaphysics: Rudolf Hermann Lotze; and ethics: Eduard von Hartmann (1842–1906) – *Phänomenologie des sittlichen Bewußtseins*, 1879. It also occurred in anthropology and psychology: e.g. Heinrich Moritz Chalybäus (1796–1862) – *Phänomenologische Blätter*, 1840, Józef Kremer (1806–75) – *Rys fenomenologii ducha*, 1837; theology: e.g. Pierre Daniel Chantepie de la Saussaye (1848–1920); and politics: Pierre Joseph Proudhon (1809–65).

Psychology and Physics. Hegel's influence in the humanities, along with the rise of neo-Kantianism and its impact on physics, contributed to a widespread use of the term in these and other fields, especially between 1880 and 1900: in the work of Franz Brentano and his pupils in psychology, of Wilhelm Wundt (1832–1920), and later of Ernst Mach and his pupils in both physics and psychology.

In 1894 Mach pleaded for "a *general phys-*

ical phenomenology, embracing all domains", opposing it to mechanical, i.e. metaphysical explanation in physics (*Principien der Wärmelehre*, 1896). He was shortly after followed in this by Paul Volkmann (1856–1935), Ludwig Boltzmann (1844–1906), and Hans Kleinpeter. Mach's influence reached far into 20th-century physics, where phenomenology still plays a role in thermodynamics and in the theory of ferroelectricity.

Brentano himself seldom used the term 'phenomenology'. But it occurs in the title of his lectures 1888–9, where he equates descriptive psychology (as basis for genetic psychology) with descriptive phenomenology, defining the latter as "the analysing description of our phenomena, i.e. our immediate empirical facts or the objects which we grasp in our perception" (*Deskriptive Psychologie*, 1982). A number of his pupils and adherents continued Brentano's preference for phenomenological psychology, the most important among them being Alexander Pfänder and Edmund Husserl.

Pfänder, in his *Phänomenologie des Wollens* (1900), saw phenomenology as "an elementary investigation for founding psychology", as a *subjective* method and as foundation for the explanation of phenomena of consciousness in terms of causal relations and laws. Here phenomenology is conceived as *analysis*. In Pfänder's earlier writings, however, it is taken as the mere *description* of psychical phenomena.

In the same year Husserl published the first volume of his *Logical Investigations*. Here phenomenology is still "descriptive phenomenology of inner experience", i.e. descriptive psychology in Brentano's sense as basis for empirical psychology and epistemology.

In a manuscript of spring 1899, Husserl, in a Pfänderian sense, had written about the fundamental distinction "between the subjective and objective, or to put it otherwise, phenomenological and objective way of contemplation". Around 1902–3 Husserl abandoned his view and redefined phenomenology as relating to "the given in the strictest sense, the experience, as it is in itself" thus apart from the empirical subject. This notion anticipates his later idealistic view of phenomenology.

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NIELS W. BOKHOVE

Phenomenon

Phenomenon (Greek φαινόμενον) = appearance, from *phainesthai* (φαίνέσθαι) = to show itself, to appear, from *phainein* (φαίνειν) = to show, to bring to light).

Antiquity. The term probably comes from Greek astronomy, and more specifically from Cleostratos of Tenedos (*c.* 520 BC), who wrote a poem titled *Phainomena* or *Astrologia*. The first philosophical use was made by Anaxagoras (*c.* 500–*c.* 428/7 BC) in his famous reference to "the sight of the invisible things [offered by] the phenomena" (Diels, fr. 59B21A). Primarily meant as an epistemological statement, it certainly had a methodological influence on early Greek medicine, notably on the *Corpus Hippocraticum* (*c.* 430 BC), where we read: "People do not know [how] to observe the invisible, starting from the visible" (*On diet* XI.1), referring to the inference from morbid symptoms to their cause(s).

In the 4th century BC the formula 'saving the phenomena' – 'the organizing principle of modern science since Galilei' (Mittelstraß 1962, p. 2) – was introduced into Greek methodology, supposedly by Plato, who challenged the astronomers of his time to give a theory solving the astronomical problem of the apparently irregular planetary move-

ments (Simplicius, *Comm. De Caelo* II.12). Eudoxus of Cnidus (*c.* 408–353 BC) accepted the challenge and framed his astronomical system in his work *Phainomena*.

In Plato the antithesis between phenomenon and truth, illusion and being, untrue appearance and true reality, plays an important role, as can be seen in his treatment of the art (e.g. at *Rep.* X 598b, *Theaet.* 157e–158a). 'Phenomenon' had in general a negative ring for Plato (*Rep.* 596a).

Aristotle opposed phenomenon to cause (αἰτία) and conceived his scientific methodology along the lines of that of Hippocrates according to which the description of the phenomenon must precede explanation or aetiology (*De part. anim.* 639a7–9, cf. *Pr. An.* 46a17–22). More important is his introduction in e.g. *De Caelo* 270b4 of a second meaning of 'phenomenon' in addition to the traditional, objective meaning of 'natural appearance'. Here 'phenomenon' acquires a subjective meaning as '*endoxa*' (ἔνδοξα) ('prevailing opinion' or 'belief').

Around 300 BC the mathematician Euclid of Alexandria wrote his mathematical-descriptive and axiomatical 'elements of astronomy', the *Phainomena*, which had a great influence on both Greek and Arabic astronomy.

Extremely influential was Aratos of Soloi's (*c.* 310–*c.* 239 BC) astronomical poem *Phainomena* (270 BC), inspired by Eudoxus's prosaic work and consisting of a description (ἔκφρασις) of the then-known constellations. As it was intended as a practical agricultural and nautical guide, it does not try to give explanative theories, thus complying with Alexandrian methodology. Aratos's influence can be seen *inter alia* in the commentaries and translations by Geminos of Rhodos, Ovid, Hipparchos, Cicero, and Germanicus Caesar.

Mainly following Hippocratism and Aristotle, Galen (*c.* 129/30–*c.* 199/200) introduced the concept of phenomenon into medicine. In his *Institutio logica* he makes a distinction between phenomena in sense perception (αἴσθησις) and in mental representation (νόησις). His pupil Theodorus Priscianus (*c.* 400) called the first chapter of his pharmaceutical book *Euporiston* "Faenomenon", treating remedies against external diseases, while the second, "Logicus", belongs to 'rational', i.e. logical-inductive medicine.

Crucial in the history of the concept 'phenomenon' are the skeptical works of the physician Sextus Empiricus (*c.* 150–*c.* 225), especially his survey of the doctrine of Pyrrho (*c.* 365–*c.* 270 BC), Πυρρωνεῖαι ὑποτυπώσεις. Sextus opposes phenomena to '*intelligibilia*' (νοούμενα) on the one side and to the Anaxagorean '*adèla*' (ἄδηλα) on the other. On the first pair phenomena are equal to 'sensibilia' or sense objects (αἰσθητὰ), opposing 'intelligibilia' or mental objects (νοητὰ). As for the second combination, Sextus remarks that propositions about the ἄδηλα are impossible, we have to suspend our judgement (ἐποχή).

Renaissance. During the Middle Ages Aratos's work was well known in both Latin and Arabic translations; Sextus's work was only slightly known, but the concept of 'phenomenon' (mostly translated as '*apparentia*' or '*ea quae videntur*') did not play a part of any importance. Things changed during the Renaissance, when in the 16th century both works were introduced into Western Europe through Latin and later also Greek editions. Their influence on European thought was overwhelming above all as concerns Michel de Montaigne (1533–92), Francisco Sánchez (*c.* 1550/1–1623) and later Pierre Gassendi, Marin Mersenne (1588–1648), and René Descartes, but also through the sciences, notably astronomy (Tycho Brahe, Johannes Kepler, Nicolas Copernicus).

Georg J. Rhetikus (1514–74), a pupil of Copernicus, wrote a (lost) work *Of the Phenomena* with the intention, "that astronomy be free of hypotheses, I shall be satisfied with only observations" (K. H. Burmeister, *Georg Joachim Rhetikus 1514–74*, Wiesbaden 1967f). This turn from aetiological speculation was prompted by the failure of the Ptolemaic – and in fact also Copernican – systems to 'save the phenomena'.

17th century. Francis Bacon planned to compile a "*Phaenomena Universi, sive historia naturalis et experimentalis ad condendam Philosophiam*" in the spirit of Rhetikus, i.e. an inventory of natural phenomena, both physical and mental, as part of his

unfinished *Instauratio Magna*. This 'natural history' should be simple, undogmatic, unbiased, factual, complete, descriptive, in short, pertaining to the '*phaenomena ipsa*' alone. But, unlike that of Rhetikus, Bacon's enterprise was ultimately meant as the basic material for the explanation of all phenomena according to his inductive method.

Bacon was, together with the astronomy of his day, the source for the introduction of the term 'phenomenon' into 17th-century philosophy. Rudolf Goclenius defined it in his lexicon as "in itself manifest to the senses. Appearing to a sense. And the opposite of reason and theoretical demonstration". Johannes Micraelius (1597–1658) defined it as

> appearances, which are not true and real, but seem to be so. In astronomy they are yet also called, anything which is observed in heaven and beneath it but above us.

Both Descartes and Gassendi (and also Spinoza) used the term at first in its Aratian, astronomical sense, including meteorological phenomena like the rainbow and parhelia. Instead of explaining one single phenomenon, Descartes planned "to explain all phenomena of nature, i.e. the entirety of physics" (*Oeuvres*, ed. Adam/Tannery, I, p. 70). In 1632 he wished that somebody would undertake

> to write the history of celestial appearances, according to Verulamius' method, and that he exactly describes for us, without assuming any reasons or hypotheses, the sky as it appears now (I, pp. 251–2).

Descartes seems to have been thinking of executing Bacon's original project of a purely descriptive, unbiased *Historia naturalis* (cf. VIII, p. 81).

The same goal was pursued by Gassendi, who, also explicitly referring to Bacon dreamed of a science, "which I like to call [the science] of phenomena or historical". At the same time however he believed it to be a science, "which I have to leave entirely to God who, being the architect of nature, is the only one able to have insight into his plan of work" (*Opera omnia*, VI, pp. 110–11).

During the 17th century the term 'phenomenon' gained a wider use in the natural sciences, notably in optics, chemistry, mechanics, and technology. It came to refer to experimental phenomena, e.g. as produced in the laboratory. Robert Boyle (1627–91) realized at last that "we are yet, for aught I can find, far enough from being able to explicate all the phenomena of nature by any principles whatsoever".

Thomas Hobbes included a "*Physica, sive de naturae phaenomenis*" in his *De Corpore*, defining 'phenomena' as the 'real and existent' 'motions and magnitudes' of bodies. Empirical, inductive physics, starting '*ab effectibus phainomonis*', tries to explain their '*generatio*' or causes, while its theoretical counterpart ('natural philosophy'), starting from causes and using definitions, attempts to conclude to phenomena in a discursive, deductive way. Like Gassendi, Hobbes believed that man's knowledge on this point is limited (*Engl. Works* I, pp. 386–9).

A milestone in the history of the concept of phenomenon is Sir Isaac Newton's use thereof. The third book of the second and later editions of his *Principia* begins with "Regulae philosophandi" followed by "Phaenomena", i.e. the planetary movements. The fourth rule formulates his fundamental methodological principle, stating that only immediately observable phenomena may serve as the foundation of physics; all other conclusions, leaning on 'occult qualities', on a beyond not open to immediate observation, are speculation or hypothesis. This principle pertains also of course to the ultimate cause of gravity, about which he says in the "*Scholium Generale*": "hitherto I have not been able to discover the cause of... gravity from phenomena, and I feign no hypotheses". The same "*Scholium*" as well as "Query" 28 to his *Optics* make it clear that Newton's dislike of hypotheses had a religious background inspired by his pupil Richard Bentley (1662–1742). To man only knowledge of the phenomena as properties or attributes of things is possible; knowledge of the underlying substances is reserved to God.

Newton's rival Leibniz was actually the

first to subject the concept of 'phenomenon' to serious philosophical reflection. For him science is the attempt to explain the phenomena (*Philosophische Schriften*, ed. Gerhardt, I, p. 173), which are for him the primary properties of matter: extension, figure, and motion. A letter of 1675–6 shows that, like Bacon, Leibniz used 'phenomenon' also in a mental sense, referring to phenomena of consciousness having an external cause (I, pp. 370–3). This dual meaning is treated in Leibniz's "*De modo distinguendi phaenomena realia ab imaginariis*" (*c.* 1700), which deals with the question how we are to distinguish phenomena caused externally from those caused internally. Three criteria are developed: the vivacity and vigour of the impression in consciousness, the compatibility with precedent phenomena, and the predictability from precedent and present phenomena (III, pp. 318–20). The externally caused phenomenon is '*bene fundatum*', i.e. '*ex Monadibus resultans*' (VI, p. 590).

Leibniz's pupil in many things, Christian Wolff, generally defined 'phenomenon' as "anything presented to the senses, which is confusedly perceived", criticizing Goclenius, and mainly following Leibniz as to its specific meaning. Wolff's pupil Georg Bernhard Bilfinger (1693–1750) stressed the distinction between phenomenon and cause, between the factual-historical and the rational-dogmatical, between experience and judgement (*Harmonia animi et corporis humani*, 1723, p. 22), while another Wolff pupil, Alexander Gottlieb Baumgarten (1714–62), underlined with his teacher the observability of the phenomena: "We call those things 'Observabilia (phaenomena)', which we can know through the senses (confusedly)".

Returning to the traditional correspondence-theoretic criterion of truth, the anti-Wolffian pietist Christian August Crusius distinguished between '*phaenomena contradicentia*' and '*difficilia*': the first contradict religious propositions; the second must be deduced from such propositions. Crusius sees the correspondence between a proposition and a phenomenon as one of the sources of probability. A phenomenon then is something

> which is known in a demonstrative or probable way already from elsewhere, and which has a possible causal relation to that which in a proposition is supposed as possible.

Interesting are also his distinctions of 'simple' and 'harmonic' and of 'strong' and 'weak' phenomena (*Weg zur Gewissheit*, 1747, pp. 661, 691–2, 693–4, 698–700).

Gottfried Ploucquet (1716–90), also a pietist and originally a Wolffian but later independent, investigated in his *Principia de Substantiis et Phaenomenis* (1753) the element of idealism (understood in its ontological sense) in Leibniz's monadology. Ploucquet rejected the monads and limited himself to a subjectivistic phenomenalism. He arrived at a kind of Husserlian *epoché* (ἐποχή) in saying:

> I do not dare to conclude from the representation of phenomena to their existence, as I do not perceive in the idea of a representation in me the idea of a strange existence. . . . In the idea of my representation I do see my existence, but not the existence of something else.

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Philoponus. See: John Philoponus

Phonology

An outstanding characteristic of human 'natural' language is the linearity of its messages, which is nothing else but the fact that *contrasts*, i.e. relationships among elements found together within one message, are displayed along one dimension only. Even though such linearity is far from complete, it has impressed many students of language for centuries, characterizing as it does both the first and second articulation, i.e. not only the relationship among meaningful elements but also that among non-mean-

ingful but distinctive ones. The latter are the *phonemes*. For thousands of years students of language have been aware of the existence of phonemes, i.e. minimal segments within the spoken message whose presence is relevant for distinguishing one message from a different one with another meaning even though the phonemes themselves lack any meaning whatsoever. (An anticipation of a modern phonological treatment is to be found in the work of King Sejong of Korea (reigned 1418–50), the founder of the Korean featural script *Han'gŭl*; see Sampson 1985, pp. 120–44.)

The main difficulty concerning the existence and nature of phonemes is that each of them underlies a great many different phonetic realizations. Such a phonetic variation depends on a number of factors. There are individual, free, and contextually conditioned variations, whether accountable for in terms of phonetic influence of neighbouring sounds or not. Even though for thousands of years many people have known about the existence of phonemes in spite of such variations, 19th-century linguists focused on the phonetic realizations themselves.

The Russian linguist Jan Baudoin de Courtenay (1845–1925) was one of the first to anticipate the modern notion of phoneme, developed in the structuralist movement initiated in 1916 with the publication of the *Cours de linguistique générale* by Ferdinand de Saussure (1857–1913). That book does not, however, reach the stage of a clear acknowledgement of the phonemes. The main developments in the conception of the phonemes were attained in the Prague School during the 1919–39 period (especially by Nikolai Sergeievich Trubetzkoy, 1890–1938), in the American distributionalism initiated by Leonard Bloomfield (1887–1949), and in the French functionalist school headed by André Martinet (born 1908), with three non-mainstream tendencies represented by the British structuralist linguist John R. Firth (1890–1960), the 'glossematics' school of Copenhagen, started by Louis Hjelmslev (1899–1965), and the *generative phonology* developed by Morris Halle (b. 1923) and Noam Chomsky (b. 1928).

The American distributionalist school insists on a physicalist and set-theoretic view of the phonemes, as mutually disjoint classes of sounds. Glossematics regards phonemes as purely abstract entities having nothing to do with phonetics; according to such a view there is nothing to a phoneme but what serves to make it different from other phonemes, regardless of whether they are realized phonetically, graphically, or through gestures. Martinet has a purely functionalist view of phonemes, but one which does not dispose of phonetic realization: he regards phonemes as entities whose reality is purely relational – distinctive (that is to say, such that a phoneme is individuated by that which differentiates it from other phonemes) – but which are characterized in phonetic terms; he rejects the disjointness principle the distributionalists cleave to; he develops Trubetzkoy's ideas on neutralization (the process by which in certain environments the difference between two or more phonemes is lost, a process consisting in the fact that in those contexts certain distinctive features serving to differentiate those phonemes are no longer relevant: for instance in word-final positions in German voiced /d/ is pronounced like voiceless /t/, the feature *voicedness* lacking relevance in that context) via the notion of the *archiphoneme*, which would be a phonemic entity occurring in those contexts and comprising all realizations of any of those phonemes; that is to say, in word-final positions in German there would be neither /t/nor /d/, but the archiphoneme /T/ instead; but of course such an analysis is by no means the only possible one. Notice that a *distinctive feature* is any phonetic property relevant for differentiating at least two phonemes from one another. All those schools insist on positing for each language one list of phonemes only, whereas Firth's *polysystemic* approach maintains that for different phonological contexts there are different lists of alternative phonemes – which avoids resorting to the notions of neutralization and archiphoneme. The polysystemic approach, rigorous though it doubtless is, has been generally rejected owing to its enormous complexity and perhaps also to some arbitrariness in drawing the inventory of contexts which determine respective phonemic systems.

While all the aforementioned schools take

phonemes to be the basic units, generative phonology bestows priority on the *distinctive features* instead, and regards phonemes as mere classes of distinctive features. Moreover, generative phonologists, besides being about the only ones to conceive of distinctive features as universal, generally regard them as necessarily binary – each feature being characterized as a phonetic property, which is either downright absent or else fully present. For instance, the English phoneme /ĩ/ is characterized as: [+ syllabic], [−consonantal], [+ sonorant], [+high], [− low], [+ voiced], [− tense], [–round], [+ front], [− back], [–nasal], [–long], etc. – although such a characterization contains a lot of redundancy, since not all those specifications are independent. (Defining any of those features goes beyond the scope of this article.) Another peculiarity of generative phonology is that it posits different levels, with one deep level at which there may be phonemes having features which are not manifested at all at the surface level – an ordered set of rules turning the deep input into the surface output.

Generative phonology has gained widespread acceptance even outside the English-speaking world. However, a great many linguists have qualms about the existence of deep levels far away from surface realizations and even more about the psychological reality of such a deep level or the rules governing the generation of the surface output. (When once, however, one takes issue with Chomsky's assertion of that psychological reality, the whole nature of the generative process becomes very dubious.) There is scarcity of empirical evidence in support of such posited entities, and even abundance of indications pointing to total lack of awareness of their existence on the part of naïve speakers. Moreover, the universalist view of distinctive features can hardly be reconciled with many of the empirical data, while the strictly transitionless binarist principle (the stipulation that all phonological phenomena are to be accounted for in terms of the presence or absence of different properties, with no property being allowed to come in degrees) has been argued to run counter to the continuous, gradual nature of the physiological and psychological processes involved. Furthermore, distinctive features are likely to be regarded as somehow less present than the phonemes themselves in the consciousness of naïve speakers. In fact what most commonly differentiates two phonemes is not so much one or several definite distinctive features as a fuzzy cluster thereof.

Thus, e.g., it can be argued that what sets English /p/ apart from /b/ is not just its voicelessness, or its aspiration, which is not realized in certain contexts, but a fuzzy cluster of the fuzzy features of being *fortis* (as against *lenis*), voiceless, aspirated, all three of which vary in degree according to context and depending also on individual or other parameters. /p, b/ are characterized in English as being bilabial plosives, but in fact they are distinguished from other phonemes by a fuzzy cluster of features, plosiveness and bilabialness varying in degree, /p, b/ being sometimes realized as either non-plosives or non-bilabial (e.g. in 'hopeful' or 'subversive').

Furthermore, the choice of distinctive features in generative phonology can be regarded as somehow *ad hoc*, with most features being described in articulatory terms (i.e. terms applying to anatomic or physiologic properties pertaining to the utterance of linguistic messages) while others are acoustic. Sometimes a feature raises the suspicion of having been invented in order to complete the binary framework.

Some of those misgivings can probably be dispelled, although they raise important methodological issues. However, the study of phonemic structures is likely to have much to gain from a gradualistic approach. In fact there seem to be lots of borderline cases, such as sounds which up to a point are allophones of (i.e. belong to) some phoneme but to some extent are allophones of a different phoneme; or sounds whose phonemehood is far from complete, whether in some particular contexts or generally; or clusters of sounds which while to some extent constituting one phoneme do not reach the same level of unity as other sounds do (the English affricate pronunciation of 'ch', e.g., or diphthongs such as that in 'how'). Through a gradualistic treatment – according to which so-called clear-cut situations would be just limit cases – synchronic phonology could tally

with the diachronic study in a simpler way than is customary. It is too early, though, to assess the real merit of a gradualistic approach in phonology. (In this connection, an obstacle to be overcome is a widespread adherence to classical logic, which tends to reduce all yes/no questions to alternatives between 'completely' and 'not at all', whereas there are some non-classical logics which, while keeping the excluded middle principle, '*p* or not *p*', and even the strong version '*p* or not-*p* at all', drop what can be termed the classical or over-strong excluded middle, namely 'Either it is completely the case that *p*, or else it is not the case that *p* at all'; classical logicians are prone to view this schema as only stylistically different from '*p* or not *p*'.)

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Physicalism. See: Materialism, Physicalism

Pico della Mirandola. See: Renaissance Philosophy

Plato

At the heart of a philosopher's metaphysics lies an ontology which specifies what is taken to be existing, and what are to be the fundamental categories of reality. Philosophical ontologies consist not of item-by-item enumerations, but of characterizations of genuine ontological categories. Thus we can ask of Plato, as of other philosophers, what he took to be real and what he took to be fundamental.

An ontology can have an explanatory structure, or be more of an inventory. If it is the latter, then it tells us what exists but bypasses questions of fundamentality. Recent influential Anglo-American ontologies have been primarily inventories. Thus, e.g., the 'realism' of Bertrand Russell and G. E. Moore tells us that in addition to particulars universals exist. The nominalism of Nelson Goodman, on the other hand, maintains that only particulars exist.

Plato's ontology is radically different from both of these accounts. It is an explanatory theory, in which more fundamental elements account for the existence and nature of the less fundamental ones. In passages like *Phaedo* 96–106, the ontology that became known as Plato's Theory of Forms emerges out of a search for what underlies explanatory patterns within which we can account for the most important features of reality. For Plato these features include: order, harmony, stability, and intelligibility. His proposal is, roughly, that these features depend on the existence of certain attribute-like entities and on their relations to what is in space and time. These entities are the Forms. (For a detailed account and alternative interpretations see Gallop 1975.) The Theory of Forms emerges in the context of the distinction, drawn already by Plato's predecessors, between appearances and underlying reality. The existence and nature of the Forms account for the order and harmony reflected in the natures of spatio-temporal particulars.

We shall contrast Plato's favourite explanatory pattern with two prominent ones promoted by his predecessors. In epic and other literature embodying mythological accounts, the most salient facts are accounted for in

terms of origin. Both the accounts of nature in general and of the outstanding characteristics of heroes contain origin as the explanans. E.g., a hero has unusual strength because his mother was a goddess. To be sure, early Greek literature contains many descriptions having subject-predicate form, and the Homeric age had some primitive technology, but these structures did not become objects of conscious analysis.

Explanations in terms of origin (e.g. cosmogonies) can easily be changed into analyses in terms of constituency. The ancestor is responsible for what the progeny has, presumably, because they share a common constituent. Within this pattern influential explanations will posit a small number of underlying constituents, accounting for surface variety. The constituents need not be as obvious as chunks of stuff. But as the posited constituents become more sophisticated (atoms, fire, mind, justice), the nature of the explanation becomes more problematic. In what sense does the world 'contain' justice? Furthermore, mere enumerations of elements do not constitute explanations. What accounts for the nature of these elements? In what order or arrangement need they coexist as the substratum for all else? These questions lead Plato to the view that the basic explanatory pattern for elements of reality must be analysis in terms of theoretically important attributes.

Elements of nature are what they are and function the way they do because they instantiate certain attributes. This is the attributive analysis. It has many variants. We shall look at Plato's distinctive version.

The explanandum is the extent to which there is order and thus intelligibility in the world. The explanans is the realm of Forms and its relation to the spatio-temporal. The Forms are not simply attributes in the modern sense of this word. They are not just what many things have qualitatively in common. Each Form has a peculiar nature from which the natures of things participating in them is derived.

Forms correspond only to a few of the universals of the modern realist, namely mathematical, geometrical, ethical, and quantitative measurement attributes, as well as those corresponding to the teleological aspects of natural kinds and of the production of artefacts. Forms differ from universals also in nature. For the partaking relation is at most a qualified instantiating relation. Furthermore, Plato characterizes the Forms in self-attributional ways and with locutions like "the Equal itself". This is meant to characterize the complete natures of the Forms of which the participants reflect only aspects or parts. (See Moravcsik 1976.)

Plato's theory differs from what later became known as essentialism, i.e. the view that each natural kind has as its essence a unique set of necessary and sufficient attributes. Plato's Forms explain how mathematics, geometry, etc. are related to elements in space and time. This need not lead to finding an essence for each kind.

In addition to the passage from the *Phaedo* already mentioned, the educational curriculum of *Republic*, Book VII also shows that Forms correspond only to a few selected subsets of the domain of universals. (For a view finding more similarities between Forms and universals see, however, Ross 1951.)

Cherniss (1936) pointed out that the Forms have explanatory roles in Plato's metaphysics, epistemology, and ethics. We are concerned with the explanatory role these entities have in metaphysics.

Certain propositions of mathematics, geometry, or medicine are false when applied to particulars and yet underlie certain truths about these entities. The Forms are what make such propositions true, and their relationship to particulars accounts for the derivative truths applicable to these.

For example, a theorem of geometry might deal with lines without width and points without extension. As such it is not true of particulars in space and time. Nevertheless it underlies many of the qualified true statements that hold of the empirically given world of time and space. According to Plato the first proposition, i.e. the theorem, is about the Forms, and the second type about participating particulars. The Forms and their interrelations make the first true, and their relations to particulars make it possible for the second type to be true.

Again, simple mathematical propositions

like $2+2=4$ are not true about spatio-temporal particulars, for nothing is simply 2 or 4; it has to be two trees, two countries, etc. Nevertheless the mathematical propositions underlie the related true statements about two trees, two institutions, etc. This relationship is due to numbers being Forms, and collections of particulars being participants in Forms. (For an alternative reading see Wedberg 1955.)

The *Timaeus* presents astronomical patterns as ideal geometrical patterns. As such they cannot apply without qualifications to the actual movements of the celestial bodies. According to Plato the patterns are constituted by some of the Forms and their interrelations, and the actual motions partake of these.

The same point can be illustrated with regard to what Plato says about measurement. The basic notions are: equal to, greater than, and lesser than. These do not apply without qualifications to particulars. Whatever is equal to or greater than something is so in respect of length, width, area, etc. Still, the qualified statements applicable to particulars could not be true without being derivative from propositions made true by the Forms and their interrelations. Measurement is applicable to the world because it is derivative from propositions that are true of a different realm.

In medicine we see the same split. Health for Plato is a certain harmony between bodily constituents. But in actual cases this harmony is realized in a variety of ways, different in terms of age, gender, habitat, etc. Thus a theoretical statement about relations of bodily constituents without qualifications is not applicable to actual cases. The qualifications added are from a modern point of view different from those needed in geometry or mathematics, but these differences do not matter for Plato.

Excellences of character present us with the same situation. Courage, for example, is the excellence of the second part of the soul, involving rational guidance for certain emotions. (*Rep.*, Book IV, for interpretation see Annas 1981.) But there are different kinds of courage. Courage is needed in different ways in politics, on the battlefield, or in maintaining loyalty. Thus spelling out courage for concrete cases requires many qualifications to be added to the ideal characterizations given in terms of the Forms. The absurdity of realizing an excellence in every way is seen clearly in the case of wisdom. What would it be like to be wise in every way? One would have to have an omniscient understanding, with insight into all of the structures of mathematics, ethics, geometry, medicine, etc. – clearly an impossible task.

These examples illustrate the explanatory role that the Forms play in Plato's ontology. There is no room for perfect particulars in this theory. As *Phaedo* 74–9 shows, the Equal underlies all the different ways in which things can be equal. If a particular would be equal in every way to another particular, the principle of the identity of indiscernibles would collapse the pair.

Since the Forms make up the final explanans, they have to be self-sufficient. They have 'being' (i.e. complete nature and fundamentality) in a way in which nothing else has, and the being of all else derives from the Forms. (For a discussion of degrees of reality see Vlastos 1965.) Self-sufficiency requires the Forms to be independent of particulars, thus accounting for why Forms need not be instantiated.

Our survey of the unqualified nature of the Forms and the qualified nature of the particulars shows that the latter make up – from a modern point of view – a heterogeneous set. Some of the modes of qualification are: the general versus the specific (equality vs. equality in length), the ideal versus the actual (as in geometry), the context-independent versus the context-dependent (e.g. health vs. health for babies, adults), and the abstract versus the concrete example (as in mathematics). Plato sees in all of these applications the same contrast of Forms with pure natures and particulars with incomplete and qualified natures.

There are only a few traces of genuine Platonism in contemporary philosophy. One of these is the Platonist position concerning the foundation of mathematics, according to which mathematics is a series of discoveries, dealing with an antecedently given domain. Another would be a psychology that centres

on notions of aspiration and orientation, rather than on mechanistic notions of motivation. A Platonistic ethics would derive moral wisdom from what gives humans meaning in their lives.

Plato's metaphysics and philosophy clashes with any view that interprets ethics and epistemology as ontologically neutral and in this sense autonomous.

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Plenitude

Arthur O. Lovejoy (1873–1962) coined the term 'principle of plenitude' in his book *The Great Chain of Being* (1936), a study of the history of three 'unit ideas' from Plato to the 19th century. According to Lovejoy, unit ideas are certain basic ideas which, in a more or less explicit form, survive through the centuries. The task of a historian of ideas is to elucidate past forms of thought by analysing their presuppositions, i.e., by isolating unit ideas and tracing their occurrences in different combinations.

The three unit ideas studied in the *The Great Chain of Being* were treated as components of the idea-complex to which the title of the book refers. The first Lovejoy found in Plato's doctrine of the divine Demiurge, who could not be envious of anything not itself and who therefore translated all possibilities of being into actuality. Lovejoy called this ontological assumption the principle of plenitude (P) and defined it as follows: "No genuine potentiality of being can remain unfulfilled". The other two unit ideas pertaining to the thought of the great chain of being were said to be found in Aristotle. The principle of continuity states that all theoretically possible intermediate types between two given natural species are realized, and the principle of unilinear gradation is the thesis that all beings belong to a single graded *scala naturae* in which their status is determined by their degree of perfection.

In the 3rd century Plotinus organized this idea-complex into a coherent general scheme which then influenced medieval thought. Lovejoy tried to show that many medieval thinkers accepted the principles of plenitude, continuity, and gradation but evaded their consequences in order to avoid heresies with respect to the freedom of choice of God.

In dealing with the Renaissance period, Lovejoy mainly followed the interplay between the three unit ideas and the widening of people's ideas about the actual universe. In the philosophical systems of the 17th century (Spinoza, Leibniz), the principle of plenitude is said to be construed philosophically, as an implication of the principle of sufficient reason. According to Lovejoy:

> It was in the eighteenth century that the conception of the universe as a Chain of Being, and the principles which underlay this conception – plenitude, continuity, gradation – attained their widest diffusion and acceptance . . . One of the principal happenings in eighteenth-century thought was the temporalizing of the Chain of Being.

This led to evolutionary interpretations of the principle of plenitude, and Lovejoy saw their culmination in F. W. J. Schelling (1775–1854), whose evolutionistic metaphysics asserts that all genuine possibles were destined to realization in the evolutionary process and that God himself was involved in this becoming.

Lovejoy's book is one of the most influential works in the history of ideas in the last half-century. It has stimulated further studies in many areas, some of them critical towards Lovejoy's method and details of historical interpretations. Methodological criticism is

mainly directed toward the conception of unit ideas. It has been argued, e.g., that instead of taking the principle of plenitude as an autonomous item consisting of three unit ideas, one should treat it as a starting-point or consequence the conceptual background of which in different thinkers may be quite different.

It has been argued in recent studies that the lack of the idea of alternative worlds pushed ancient modal conceptions towards an acceptance of (P), although there were some attempts to develop models for individual diachronic possibilities which could remain unrealized. The idea of spelling out the meaning of modal notions with the help of synchronic alternative states of affairs became a systematic part of modal thinking in 12th century thought, where it was connected with the doctrinal view that the possibilities of God, acting by choice, refer to alternative histories.

Although the new understanding of modality strongly qualified discussions of divine possibilities, the traditional modal paradigms implying (P) were largely applied outside theology. In John Duns Scotus, we find a remarkable formulation of the intensional interpretation of modality as referential multiplicity. In his modal theory, the domain of possibility is characterized as an infinite domain of thinkability which, without having any kind of existence, is prior to all being and thinking. It is partitioned into equivalence classes under the relation of compossibility. One of them is the actual world. This model was widely used in the 14th century, and it was also the basis of Leibniz's modal thought.

Lovejoy did not pay attention to these changes of the understanding of the nature of modality and their influence on attitudes toward (P). Since the 14th century, there has been a many-sided discussion of the nature and foundation of modality and of the distinction between conceptual and natural modalities. The main reasons for accepting (P) have been difficulties with the idea of alternative domains and epistemological considerations pertaining to knowability of possibilities. In the last three decades, modal notions have been increasingly defined with the help of possible world semantics without any reference to (P).

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SIMO KNUUTTILA

Plotinus. See: Neoplatonism

Polish Logic. See: Logic IV

Pomponazzi, Pietro

Pietro Pomponazzi was born in Mantova in 1462 and died in Bologna in 1525. He was the most important representative of Renaissance Aristotelianism. He studied philosophy and medicine at Padua (one of his teachers was the Thomist metaphysician Nerotone) and became in 1488 professor of philosophy at Padua, where his colleagues included the Averroist Vernias (died 1499) and Vernias's pupils Agostino Nifo (*c.* 1469/73–*c.* 1546) and Alessandro Achillini (1463–1512). After a period in Ferrara and Padua he left definitively for Bologna, where he held the chair of philosophy from 1511 to 1525. His students in Bologna included Contarini and Gonzaga. His influence was very strong in Italy during the whole century and in the following centuries in France.

His work can be divided into: (1) published and printed books, all written in Bologna; (2) non-printed books, unofficially published and copied by hand; and (3) copies of lectures, written by his students and circulating among them. Of the works in the second category, some have been printed later; of those in the third, only small parts appeared in print. Almost all deal with Aristotelian topics or are direct commentaries on Aristotle. Although

Pomponazzi was convinced of the agreement of Aristotle's philosophy with natural reason, he criticized, corrected, and completed it. In his interpretation he was influenced by Aquinas, Averroes, and mostly by Alexander of Aphrodisias. He created his own philosophical system in the spirit of Aristotle.

Most spectacular was his view on the mortality of the soul. After giving many courses and *quaestiones* about this problem, he wrote a book, *On the Immortality of the Soul* (1516), which caused many attacks upon his person. His view was that no sound proofs can be given for immortality and that man is in principle mortal and only in one point ('relatively') immortal in so far as he can have knowledge of universals. At the end of the book he states that as a Christian he does in fact believe in the immortality of the soul. He still defends an autonomous morality and considers virtue as a good in itself without any recompense here or hereafter. He had to publish two apologies against all the attacks, was almost condemned by the Vatican, but could save his position, although many people then and later considered him a hidden atheist. For his own safety he decided not to give to the printer his two other main systematic books: the first, *On Fate, on Free Will and on Predestination* (1520), is a defence of the Stoic position on necessity and determination and of the Stoic morality of conscious agreement with the order of nature; he attacks Alexander's *De Fato* and Christian positions, but submits himself finally to the Christian faith. The second, *On Incantations or about the Causes of Natural Effects* (1520), is a very strong attack on all faith in miracles and miraculous healing. Pomponazzi tries to explain all events that seem supernatural in a natural way, but makes also finally an exception for the biblical miracles.

Although often considered as a representative of the so-called double truth, implicating a contradictory truth in theology and in philosophy, Pomponazzi in fact distinguishes between an abstract theoretical autonomous philosophy pursued by professional philosophers, and a faith for the common people; both have different functions; his own concern is not to be disturbed in solving philosophical problems in a rational way. He considers man as a finite complete conscious individual being, having the chance to be sometimes happy in this life.

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WIM VAN DOOREN

Popper, Karl

Karl Raimund Popper was born in Vienna in 1902. He initially studied psychology, where his views were close to those of the Würzburg School and Karl Bühler. As a young man he was a socialist and even, briefly, a Marxist, and he worked with Alfred Adler (1870–1937). Although his fundamental ideas about science were formed, in part, in reaction to the claims to scientific status of the theories of Adler and Sigmund Freud (1856–1939), and of Marxism (see Popper's autobiography, *Unended Quest*, 1976), Popper developed his ideas in the form of criticism of Leonard Nelson's Kantian *Fries'sche Schule*, and especially of the Vienna Circle. He shared with the Vienna Circle a passion for science and mathematical logic, and the conviction that science was an exemplar of rationality. However, their substantive views differed considerably. During the mid-1930s Popper left Austria for New Zealand. At the end of the war he moved to the London School of Economics, where he taught until his retirement in 1969.

Popper is a realist (see *Realism and the Aim of Science*, 1983). He upholds the existence of a world independent of ourselves, sees the task of science as being the discovery of characteristics of this world, and champions a correspondence theory of truth. However, Popper's more specific ideas on metaphysics must be understood in the context of his epistemological and methodological theories. Some of these are well known. He rejects

induction as logically invalid and as unnecessary for science. He emphasizes (deductive) falsifiability as the hallmark of science (but not of meaningfulness). He stresses the heuristic role played by metaphysical ideas in the development of science. And he is an out-and-out fallibilist.

Popper is a critical empiricist. Scientific theories must be testable against empirical 'basic statements'. These are statements about observable states of affairs (which, however, attribute dispositional – and thus theoretical – properties to them). What we take as 'basic' rests on a revisable inter-subjective consensus as to what is the case – one that can, in principle, be questioned by anyone. The dissenter, however, must show how the dissenting claim can itself be tested. Popper stresses that while our knowledge may grow, its growth is not cumulative, but subject to revolutions in the course of which even what had previously been accepted as statements of observable fact may be called into question. For Popper, scientific knowledge is the best knowledge we have. But on his account it is not justified, nor is it belief, nor is it something that, if true, we can tell to be so. In Popper's view, there is a continuity between human and animal knowledge. Central to both is problem-solving, and humans and animals each have biologically pre-formed expectations prior to experience. This idea is a psychological reinterpretation of Kant; but Popper stresses that even such pre-formed expectations may be incorrect, and he emphasizes the trial and error character of all learning. There is, however, also a crucial difference between animal and human knowledge: humans can objectify their thoughts in language and make them objects open to critical scrutiny. (He added, to Karl Bühler's account of the functions of language as expression, communication and description (*Sprachtheorie*, 1934), a fourth function: argument or criticism.) Popper stresses the immense significance of such 'objective knowledge'; but also that much of our knowledge is tacit, and can only be objectified in a piecemeal manner.

Some themes in Popper's work are less well known. In his *Logic of Scientific Discovery* (1934), he suggested that we should treat metaphysical theories (which at the time he thought not open to criticism) as methodological proposals. The theory that every effect has a cause would thus be transformed into the proposal that we should seek for causal laws. If metaphysical theories are so interpreted, it clearly is possible to discuss their merits. Later, Popper developed a theory as to how metaphysical ideas themselves could be critically evaluated, and there is explicit discussion in his work of metaphysical issues. (See his *Conjectures and Refutations* (1963) and his 'metaphysical epilogue' to *Quantum Theory and the Schism in Physics*, 1982.) However, a methodological concern with scientific realism and with the furtherance of our understanding of the world underlies all Popper's philosophy. He thinks issues of meaning, or formal ontology, to be of little significance. Philosophical reductions – the elimination of entities by means of philosophical analysis – are at best beside the point, and a distraction from the important task of fully exploring the *prima facie* ontological richness of the world and of attempting scientific reductions. (He argues that while attempted reductions have proved immensely fruitful, they have seldom been fully successful.) However, Popper does not hold that what exists is confined to the ontology of scientific theories. Rather, he favours the speculative development of ideas to interpret and guide science, and to help us make sense of the relation between science and the rest of our knowledge – ideas which, however, must themselves be open to criticism.

Seen in this context, many features of Popper's work that may otherwise seem puzzling fall into place. Much of his work consists of a defence of realism and objectivism against positivistically inspired criticism. I include here his criticism of phenomenalist epistemology, of subjectivist interpretations of probability, and of claims that specific pieces of science have idealistic implications. Popper argues that Alfred Tarski's work can be used to rehabilitate a common-sense correspondence theory of truth and to avoid the semantic paradoxes. And he defends a physical indeterminism and a *prima facie* interactionist metaphysical

pluralism against philosophical reductionism. In his later writings (for example, *Objective Knowledge*, 1972) he has, to this end, developed a pluralistic account of 'three worlds', drawing a broad distinction between a world 1 of physical states and processes, a world 2 of mental states and processes, and a world 3 of logical contents and cultural objects. Between world 1 and world 2, and between world 2 and world 3, there is interaction. Popper's account is loosely drawn, and he readily admits that one might refine it in many directions. He disavows being engaged in ontology. And while he has argued for the reality and the relative autonomy of these worlds, he has also written that it is conceivable, but not likely, that we might one day reduce psychology to physics.

Popper's work also contains two significant strands of what might be called science-related metaphysics. The first is a realistic, dispositional but non-essentialist indeterminism, which has been argued by commentators to resemble C. S. Peirce's metaphysical views. Indeterministic ideas run through many aspects of Popper's work, from his propensity interpretation of probability to his striving for a realistic interpretation of quantum mechanics. (See *The Open Universe: an Argument for Indeterminism*, and *Quantum Theory and the Schism in Physics*, both 1982.) He also argues that the existence of knowledge may lead to unpredictability even within a deterministic system; an argument which he has applied in many contexts, from classical and quantum physics to the philosophy of history. The other strand is a biological and evolutionary approach towards perception, epistemology, language, and the philosophy of mind (on which see notably his *The Self and Its Brain*, 1979, written with Sir John Eccles).

Popper has also written on a variety of technical questions. He has addressed fundamental problems in the theory of probability such as the definition of random sequences and has developed axioms for the calculus of probability which exhibit probability as a generalization of deductive logic. He was one of the founders of the theory of natural deduction. In addition, he depicted causal explanation as a logical relation between the *explicandum* and an *explicans* consisting of universal laws and initial conditions. Modified versions were subsequently offered for the explanation of rational action in history and the social sciences, in which the 'rationality principle' and a model play roles comparable to those of universal laws and initial conditions, respectively. He has also developed a theory of verisimilitude – an attempt to understand the idea of one false theory's being closer to the truth than is another – as well as a formal theory of natural necessity.

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Porphyry

Neoplatonist philosopher (born in Tyre in 232 or 233, died in Rome 305), who published, introduced, and pursued the work of his master Plotinus, Porphyry was also an acute commentator on Aristotle. He deeply influenced the Middle Ages by his introduction (*Isagoge*) to the *Categories*, which endowed the *logica vetus* with new technical logical terms and the metaphysical puzzles that were to give rise to the famous problem of universals. It is thanks to Porphyry, as transmitted by his commentator Boethius, that the principles of the Peripatetic logic penetrated Western thought as soon as the 5th century, earlier than the renewal of Aristotle's thought.

Although the *Isagoge* intends to be an introduction to the *Categories*, it develops the connections already loosely established by Aristotle regarding the structure of propositions, between the categories (predicaments) and the predicables. The *Isagoge* is the study of the *quinque voces*, the predicables discussed by Aristotle (*Top.*, Book I,

Chapters 4, 5, and 8): definition, property, genus, differentia, and accident. Porphyry's innovation lies in his replacing definition by the notion of species, his list running thus: genus, species, differentia, property, and accident.

In his *Commentary on Porphyrius*, Boethius discusses the 'Porphyrian tree': the category substance is taken as *genus generalissimum* and divided through the predicables into a hierarchically ordered series of genera and species, which may be viewed as secondary substances: starting with substance, one successively obtains Body, Animated body, Animal, Rational animal, Man (*species infima*), Socrates (individual), by addition of differentiae to genus and species. The same ordering may be applied to other categories than substance in accordance with the predicables, thus constituting other *genera generalissima*. Many ambiguities lie in the Porphyrian classification. From the adjunction of species to the list of predicables follows the introduction of singular terms (proper names, descriptions of individuals) among subjects and the widening of Aristotle's domain of subjects. But Porphyry gives no real principle for establishing a necessary link between the Porphyrian individuals and the *species infima*, as may be seen from the difficulties inhering in his notion of accident, and his incapacity to draw a real distinction between property and accident.

Thus the Porphyrian tree does not furnish a proper way of escaping the obscurities of Aristotle's treatment of the predicables and categories, maintaining the ambiguity of the semantic status of the constituents of propositions. In his introduction, Porphyry clearly sets out the metaphysical problems arising from such a state of things, in the often quoted passage where he draws the list of possible referents of terms for two of the predicables (genus and species): do they subsist outside the mind or are they merely mental? If outside the mind, are they corporeal or incorporeal? Are they joined to things perceptible by the senses or not thus joined?

Although Porphyry modestly refuses answering such questions, because of their too lofty and metaphysical nature, his lack of acute logical analysis of the structure of propositions and the obscurities left by the Porphyrian tree have been the source of the ongoing dispute among realists, conceptualists, and nominalists, about the status of the universals.

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Port-Royal

Port-Royal, first, is a monastery; it is also a family, the Arnaulds, and, around this monastery and this family some prominent figures joined in one of the most remarkable currents of the Counter-Reformation.

Angelique Arnauld (1591–1661) was appointed, at the age of 8 years, coadjutrix of Port-Royal Abbey in the valley of Chevreuse, and at the age of 14 abbess. Later she was to discern her own vocation, and when 17 years old undertook to reform the convent, where discipline had relaxed. In 1625, the monastery was transferred to Paris; in 1648, the increasing number of nuns made it necessary to reopen the former buildings. Port-Royal admitted, among others, seventeen brothers, sisters, nephews, and nieces of Mother Angelique.

In 1619, Angelique met Francis of Sales (1567–1622); as from 1623, however, his appeasing influence was succeeded by the more austere influence of Prosper Du Verger de Hauranne, abbot of St. Cyran (born in

Bayonne, 1581; died in Paris 1643). The latter had formed a friendship, perhaps when they were fellow-students at Louvain, with Cornelius Jansen, called Jansenius (born in Acquoi, 1585; died in Ypres, 1638), who was to become rector of Louvain University and bishop of Ypres. Both friends paid particular attention to the Augustinian doctrine concerning the relation between God's grace and man's freedom. Jansenius made a summary of his ideas in a book, *Augustinus*, published posthumously in 1640. This book became the centre of the disputes concerning what henceforth was to be called *Jansenism*.

Jansenism was a sort of reaction against the compromise, tried by the Jesuits, between humanism born of the Renaissance and the requirements of Christianity. According to the Jesuit Luis de Molina (1535–1600), God gives his grace to all men; if this grace is not always efficacious, it is because some assist it, others resist it. God himself foresees from eternity which use everyone will make of it. According to the interpretation that Jansenists propose of Augustine, in contrast, God gives his grace, which is efficacious in and of itself, only to those he has chosen. The doctrine of the Jesuits amounts, on this view, to ignoring the absoluteness of God, man's nothingness without God.

Such ideas fascinated the majority of the intellectual élite of France in the 17th century, met Rome's condemnation and provoked persecutions from the royal power. Cardinal Richelieu (1585–1642) jailed the abbot of St. Cyran from 1638 to 1643. In 1661, at the beginning of the personal power of Louis XIV (1638–1715), there was a revival of difficulties. A lull followed between 1668 and 1679, when the convent was ordered to dismiss guests and postulant nuns. At the end of the reign of Louis XIV the persecution increased still further: not only were all nuns dispersed, but the monastery of Port-Royal des Champs was razed and the corpses in its cemetery exhumed.

Antoine Arnauld (born in Paris, 1612; died in exile in Brussels, 1694), called 'great Arnauld' ('*le grand Arnauld*'), brother of Angelique, was the main controversialist of the Jansenist cause, both theologically and morally. But Arnauld was highly cultured and did not teach only theology and ethics. The abbot of St. Cyran had assigned a task of teaching to the so-called 'solitaries', who since 1637 had been retiring to Port-Royal, and these had started a school whose most famous pupil was the poet Jean Racine (1639–99). Therefore the Jansenists needed, like many religious orders of that time, to write textbooks for teaching purposes.

Antoine Arnauld, assisted by another Jansenist, Pierre Nicole (born in Chartres, 1625; died in Paris, 1695), published in 1662 the *Logique de Port-Royal*, and this remained until the 19th century one of the most widespread handbooks in logic, even outside France. This work does not contain as many new suggestions as the *Logica Hamburgensis* (1638) of Joachim Jungius. Nevertheless, Arnauld and Nicole were able to bring together into a coherent whole several elements of very different origins: Aristotelian syllogistic, which in their opinion was not to be despised; the Stoic principles of the sentential calculus inherited from Chrysippus through the scholastic tradition; the rules of the method, avowedly borrowed from a "famous philosopher of this century", in whom everyone recognized René Descartes; and lastly the contents of Pascal's fragment *De l'esprit géométrique*, taken over as a whole.

Arnauld managed not only to bring to notice Pascal's remarkable conception of definition, which has influenced logicians and mathematics ever since, but he was innovative in his own right, for example in explicitly introducing into the logical terminology the distinction between the *intension* (in French *compréhension*) and the *extension* of a concept.

Two years after this *Logic*, which concerned the 'art of thinking', Arnauld, assisted by Claude Lancelot (1615–95), published the *Grammaire générale et raisonnée*, concerning the 'art of speaking'. This grammar was 'reasoned' in the sense that it sought a rational explanation of linguistic facts; it was 'general' in the sense that it analysed the universal principles upon which diverse grammatical forms are based.

Having been unable to secure the assistance of Pascal, Arnauld wrote alone his

Nouveaux éléments de géométrie (1st edition 1667, 2nd edition 1683). In accordance with his Cartesian intuitionism, he tries here to employ exclusively ostensive proceedings, without having recourse to any apagogic demonstration such as is to be found in Euclid's *Elements*.

Blaise Pascal (born in Clermont, 1623; died in Paris, 1662) became famous initially through the diversity of his scientific genius: as a mathematician, he laid the foundations of combinatorial analysis and the calculus of probability; following Girard Desargues (1591–1661), he developed projective geometry, which he preferred to the analytic procedures of Descartes and Pierre de Fermat (1601–65); from his studies of the cycloid Leibniz later derives the principles of the infinitesimal calculus. In physics, Pascal's experiments concerning the vacuum completed those of Evangelista Torricelli (1608–47) and definitively confirmed the hypothesis of the gravity of air.

After adopting Jansenism, Pascal turned out to be a talented polemicist. In his *Provinciales* (1657), censuring the Jesuits, he skilfully correlates properly theological considerations with an accusation of moral laxism. The last three years of his life he devotes to preparing an *apologia* for the Christian religion, of which, however, only fragments are found after his death; these are published under the title *Pensées* (*Thoughts*).

Pascal, even from within the Jansenist movement, preserved his originality. Indeed the principles of his apologetics presuppose the implicit adoption of the Cartesian conception of belief, in which not only the understanding but also *will* plays a part. In addition, he radically diverges from the intuitionism of Descartes and Arnauld and this perhaps explains why he swiftly suspended his own co-operation with the latter in the project of writing a *new elements of geometry*. Arnauld naïvely tries to eliminate from his demonstrations every *reductio ad absurdum*; Pascal, on the contrary, puts forward the indispensability of this kind of reasoning in order to confirm a Jansenist conception of the nature of knowledge: owing to the corruption of human nature, which reason does not escape, the true is not so much that of which we can immediately grasp the truth as that of which we can establish the falsehood of the negation; Pascal says:

> It is a disease natural to man, to believe that he directly possesses the truth; . . . whereas by nature he knows only lies and he has only to take for veritable things, the contrary of which appears to him to be false.

The practice of sciences, by showing that demonstration is not an essentially intuitive way of proceeding from the truth to the truth, entirely confirms, according to Pascal, Jansenist anthropology.

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JEAN-LOUIS GARDIES

Posidonius

Posidonius (*c.* 135–*c.* 51 BC), Stoic philosopher, scientist and historian, born at Apamea in Syria, pupil of Panaitios at Athens, widely travelled for research, became a citizen of Rhodes, where he set up his school of philosophy. He was regarded as one of the leading intellectuals of his time, and the influence of his books continued for centuries after his death. His works do not survive, but much can be recovered from fragments and references.

In metaphysics, which for the Stoics was part of natural philosophy, Posidonius was concerned with defending the Stoic position against attacks from other schools, and with following through comprehensively the philosophical system derived from two metaphysical principles, active (divine reason) and passive (matter), which constituted, governed, and explained the whole physical universe of the Stoics. Since only body can

act or be acted upon, the principles are corporeal, but, unlike elements, not subject to generation and destruction, and in themselves without quality or form. Other Stoics appear to have defended the paradox of formless body in vague physical terms (limited, reactive, resistible); Posidonius used a logical distinction: the principles *qua* principles were only conceptually distinguishable; in reality they indissolubly coexist in all that actually is, that is as individually qualified entities. But they are not mere concepts (as universals are for Stoics), but the ultimate constituents of reality.

Posidonius followed the Stoic recognition of an ontological category of incorporeal 'somethings', as with meaning, void, and time, but with elaborations of his own. For example, in the analysis of 'now' as the problem of a finite limit on an infinite continuum of time, he proposed both a conceptual limit of before and after, and a 'least perceptible time', anticipating the 'specious present' of William James.

Since God-reason, the governing, enforming, individuating principle, permeates the whole continuum of being, God is immanent in the fullest sense, although at different hierarchical levels of tension. And since it is rational, it is understandable; since cause, it furnishes complete causal explanation of the world; and since in Greek fashion, reason and good are linked, it is providential, and thus a principle of morality. Thus Posidonius's triad of God, nature, and fate are three aspects of this same principle: its nature, its field, and its law of operation. All philosophy and science follow from this position. The natural sciences (astronomy, meteorology, earth and sea sciences, biology, geography) provide the descriptive evidence for which natural philosophy supplies the aetiology. Philosophy of mind, as part of natural philosophy, claimed that moral intelligence in man (the daemon within us) was the counterpart of the rational governing principle, so giving moral philosophy (for which historiography was the descriptive science) its only absolute value, the fulfilment of moral virtue. Even logic, with its sub-science of mathematics, was not merely a defensive organon, but the sinews of the rational framework of the universe. So he regarded mathematical limits such as figure or shape as substantial, imposing determination, limitation, containment. Posidonius's polymathy was thus the deliberate logical extension of Stoicism to an integrated interrelated comprehensive and complete aetiological enquiry into an organic universe and man's place in it, based with stark economy on the metaphysical foundation of the two principles.

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IAN G. KIDD

Possibility

Although there were several different modal paradigms in ancient philosophy, the lack of the idea of alternative worlds made them similar in the sense that all genuine types of generic possibilities were considered to prove their mettle through actualization. The intuitive idea of modality as referential multiplicity was formulated in 12th-century discussions of God acting by choice between alternative possibilities and it was fully explicated by John Duns Scotus. In his modal theory, the *a priori* domain of logical possibility (the term *possibile logicum* was coined by Scotus) is divided into equivalence classes under the relation of compossibility. One of them is the actual world. Those of its alternatives whose realizations do not demand changes in the general structure of the world were called real possibilities, as distinct from merely logical possibilities. A standard example is a free choice which could have been different in the same situation. The doctrine of divine omnipotence influenced medieval discussions to the effect that all possibilities were considered realizable through divine power (*potentia Dei absoluta*). Real possibilities in the narrow sense were natural

possibilities compatible with the common course of nature (*ex suppositione communis cursus naturae*). Scotus, William Ockham, John Buridan, and some other 14th-century thinkers noticed that many of the traditional necessities of natural philosophy merely referred to natural invariances and thus did not have anything in common with what they regarded as logical or metaphysical necessities. Under the influence of Scotus's metaphysics, they considered the notions of natural (nomic) necessity (referring to empirical generalizations) and natural possibility (referring to exemplified modes of being) as typical instances of the variety of meanings attached to the modal terms.

The late medieval theory of modality strongly influenced Leibniz's philosophy, though his idea of world-bound individuals was not present in Scotus's modal metaphysics. Leibniz and Christian Wolff gave an exclusively extensional interpretation to natural or empirical modalities – the history of a world is an exhaustive manifestation of its possibilities. The actual history could be more or less dissimilar, but any difference would mean that the new world consists of wholly different individuals. The idea of modal alternatives was given up in many other philosophical systems in which the principle of sufficient reason and other metaphysical considerations led to an equation between what can be and what will be. When physical modalities tended to become redundant in deterministic world views, modal terms were often given an epistemic interpretation in the Stoic manner. This trend was supported by David Hume and Kant, and in the 19th century some thinkers attempted to reduce all modalities to epistemic probabilities. In his interpretation of probability as long-run frequency, John Venn (1834–1923) applied this reductionistic approach to physical modalities. In the same spirit, Bertrand Russell divided propositional functions into necessary, possible, and impossible, depending on whether they are true always, sometimes, or never.

In the 19th century, the modal theory based on the idea of alternative states of affairs was particularly defended by the French contingentists. It was also included in C. S. Peirce's propensity interpretation of probability and in some philosophical defences of freedom of choice and historical indeterminism. The rise of modal logic and the problems included in merely extensional approaches to philosophical questions as practised in logical positivism strongly motivated new interest in modality. These discussions have been largely dominated by the possible worlds semantics created by J. Hintikka, S. Kanger, S. Kripke, and R. Montague. Its general lines are as follows.

A sentence of a language L is logically contingent if it is true in some of the models of L and false in some of them. The models can be called 'possible worlds'. A logically contingent sentence is materially true if it is true in the actual world. If a sentence is true in all possible worlds, it is logically true or logically necessary. Logically necessary and contingent sentences are logically possible. A logically contingent sentence is physically necessary if it is true in the actual world and in its physically possible alternatives, i.e., in the states of affairs where the natural laws of the actual world are in power. Physical necessities and possibilities are also called natural or real possibilities or necessities.

There has been an extensive discussion about what kind of entities the alternative worlds are and how the distinction between real and merely logical possibilities should be drawn in different cases. One example of these discussions is G. H. von Wright's theory of diachronic and synchronic modalities. Natural or physical modalities are treated by von Wright as temporal modalities as follows. The truth of a generic proposition p at t is contingent if and only if its contradictory was antecedently possible: at t' before t it was diachronically possible that $-p$ at t; i.e., at t' it was still possible that the world would develop in such a way that, at t, it had been true that $-p$. If a proposition p at t is true but not contingently so, its contradictory is not antecedently possible. The truth of this proposition may be diachronically antecedently necessary from all times before t (strong necessity) or from a certain time t' before t (weak necessity). Antecedent possibilities may disappear. If the proposition that at t was antecedently possible and never

lost its antecedent possibility, it is possible in the strong sense at *t*. If the proposition has lost its antecedent possibility before *t*, it is possible in the weak sense at *t*. Something which was possible may become impossible or which was possible may become necessary. Changes in other directions are excluded.

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SIMO KNUUTTILA

Potentia/Actus

The distinction *potentia/actus* derives from Aristotle's *dynamis/energeia* (cf. *Phys.* I, 8 and *Met.*, IX, 6–8), a distinction which made it possible to give up the tenet of the ancients that something which is can neither come into being nor pass away (191a23–34). This pair of concepts makes it possible to understand being, generation-corruption, and movement in general, as compatible.

In this way of speaking '*B* comes to be' means: something which already is (the 'substrate') receives, through the agency of something else which likewise is (the 'agent'), a determination or form *B* (*act*), which it previously did not have, but of which it was capable (*potency, potentiality*). It receives this determination under the condition of giving up some determination *A* ('corruption', 'alteration'), which it earlier had and of which it was likewise capable (1049a5–b3).

The terms 'potency' and 'potentiality' – which will henceforth be treated as synonymous – have several meanings. First, they designate the power of an agent to effect this determination or form (the Scholastics called this the *potentia activa*). Such determination may be substantial (as when iron becomes a sword), or accidental (as when a sword becomes rusty). Second, potency or potentiality designates the ability of the substrate to acquire the hitherto lacking determination or form (scholastically: *potentia passiva*). 'Potency' in this sense includes the meanings 'not-(yet)-being' and 'able-not-to-be', but it clearly designates more than 'not-being' (1050b3–16).

Instead of 'to realize a potency' one can say 'to carry it over into act', 'to make it actual', or to 'actualize it'. 'Act' is used in at least two senses. First, it means 'realization of the potentiality to become something determinate' ('real or actual substance', 'first act', with analogous uses for accidents). Second, it means 'realization of the potentiality to effect something determinate' ('to be active', 'second act'). Becoming and passing away are always assigned to something that really exists. Every second act presupposes a first act (hence the scholastic maxim: *acting follows being*); but also every first act presupposes other first acts: one which realizes (actualizes) it and one in which it is realized (hence the maxim: *imperfection presupposes perfection*). Consequently the very first act (God) must be a pure act (pure reality without any admixture of potentiality). With this pair of concepts 'act' and 'potency', the whole of reality can be grasped, from God (who is unmixed act) to prime matter (which is pure potency).

This framework was modified in Neoplatonic philosophy in that matter was no longer thought of as something subsisting independent of the pure act, but as emanating necessarily out of first act. Among the Christian philosophers, in contrast, the conviction prevailed that matter is something which God creates freely. In both cases 'act' no longer designates merely the realization, but also the production, of a potency. This results in a bringing closer together of 'act' and 'participation in the real', as also of 'potency' and 'capacity for such participation'. In the context of Christian ontologies, moreover, it leads to the bringing together of 'potency' and 'creaturely essence'.

In medieval and 16th-century Scholasticism the notions of potency and act receive their greatest differentiation. Thus under

actus secundus the Middle Ages distinguished:

actus elicitus: act commanded and accomplished by the will (e.g. to love, to hate);
actus imperatus: act commanded by the will, but accomplished by another power (e.g. to walk, to plough);
actus humanus: free and intentional act;
actus hominis: involuntary and unintentional act which does not found responsibility;
actu signato and *actu elicito*: acts relating to the mode of transmitting information about something that is to be done, 'through words or other signs' and 'through examples', respectively.

Under *potentia* we find the late distinction between *potentia logica* (or *objectiva*) and *potentia realis*, that is, between 'mere thinkability' and 'realizability'. Regarding God, there is the distinction between *potentia ordinata* and *potentia absoluta*. The former refers to God's power in so far as he prefers to keep the natural laws he has established; the latter to this power in so far as God prefers to dispense with these laws. As late as the 18th century expressions like 'ordinary course of nature' are used to refer to this distinction.

Modern philosophers have tended, however, to modify the meanings of inherited terms. Thus even where literal translations like 'active/passive power' seem to take the place of '*potentia activa/passiva*' there are shifts of meaning resulting from changes in the concepts of matter, substance and accident. Thus in theories oriented around biological concepts of ontogenesis what is undeveloped is the potential; at the same time, however, as the preformed seed or germ – something in which everything is already present and which brings out its *imago* by its own power – the undeveloped is something highly actual. For those theories, in contrast, which see things as mechanical aggregates of corpuscles, it is these corpuscles which are properly actual, but at the same time they stand to the complexity of the visible world in the relation of potency to actuality. For comparable reasons 'potency' in the later Schelling has a function similar to 'synthesis' in the 'thesis-antithesis-synthesis' scheme.

See also: **Energeia/Dynamis**

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RAINER SPECHT

Potential

The term 'potential' gained currency during the 19th century, but the history goes back at least to Sir Isaac Newton's *Principia* (1687). It refers to a mathematical function whose derivatives relative to the independent variables of a given problem specify some desired parameters; in addition, 'equipotential surfaces' are surfaces over which some corresponding physical notion adopts a given value. To take examples in hydrodynamics, the velocity of any particle of fluid can be specified, from a so-called 'velocity potential', while an equipotential surface links up points of equal pressure in the fluid body.

Many of the classical definitions were narrower than this one, for they were tied to the inverse-square law associated with Newtonian mechanics (especially the attraction of a solid body to an exterior mass-point) and later with electrostatics and magnetism. But then it became broadened when the same approach was found to be fruitful in contexts such as electromagnetism, quantum mechanics, and nuclear physics, where inverse-squarism is not necessarily assumed. In addition, a variety of related mathematical issues arose in the development of the theory: for example, the existence and/or uniqueness of a potential function in given circumstances; or differential equations such as those named after Pierre Simon de Laplace (1749–1827) and S. D. Poisson (1781–1840), whose solutions lead to potential theory and associated mathematical functions such as the Legendre

functions, elliptic functions, and integrals, and especially the Green functions.

Various philosophical questions attend potential theory, especially when considered in its applications. For example, in some formulations of mechanics, especially that put forward by Joseph Louis Lagrange (1736–1813) in the late 18th century, a force potential (from which the forces acting in a given mechanical situation could be defined as derivatives, in the manner described above) was *always* held to exist; but then the potential takes epistemological priority over force. In addition, potentials are granted ontological status if they are held actually to exist in the physical world and not merely to serve as convenient notions in a mathematical description of the phenomena involved.

Further, the generality of a theory might be affected by adopting the tenets of potential theory; in reaction to Lagrange, for example, an important tradition in energy mechanics was initiated by Lazare Carnot (1753–1823) late in the 18th century in which the existence of a force potential was explicitly denied, so that the impact of bodies could be properly studied.

The subject is widely known and taught; sadly, the philosophy is usually missing.

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IVOR GRATTAN-GUINNESS

Predestination

Predestination has been a subject of Christian theology since its beginning. From roots in the Old Testament it has grown to a concept present in the teachings of St. Paul, Augustine, Thomas Aquinas, Calvin, and also post-Enlightenment theologians. It constitutes an article of faith for all major denominations in spite of heavy doctrinal controversies about the true meaning of the term. In philosophical terms, the problem of predestination can be rephrased as follows: any theist philosophy must be able to relate the more or less contingent course of events in the world and actions of man with God's absolute authority in a universe stemming from his act as Creator. How is this authority to be conceived in such a way as to allow the freedom of man to commit evil? For God is omnipotent and just and has an unlimited will towards perfecting the world. Why does he not necessarily lead the individual, in particular the human individual, towards its own perfection? The metaphysical significance of predestination thus depends on what metaphysical meaning is given to notions such as goodness, omnipotence, foresight, and justice when attributed to God, and what ontological status man and his freedom have.

The doctrine of predestination as treated since Augustine asserts that God's freedom in choosing by election and rejecting by reprobation does not eliminate the responsibility of man or contradict justice. Predestination does not mean determinism or a divine causality of man's actions. But it does mean that God has decided about the final state of the relationship between him and the human individual previous to any doings of the latter. If man does not reach the final state of seeing God then it is through his own guilt. A radical position adopted by some theologians asserts a 'two-fold predestination' (*praedestinatio gemina*), namely that God positively destines some individuals to commit evil and others to find the way out of evil. This assertion is seen to conflict with the preconceived idea that direct causality of moral evil must not be attributed to God. Moderate predestinationist thought stresses the 'asymmetry' between election and reprobation: the former is a positive act of God, the latter only follows upon a foreseen course of evil initiated by an individual through its own denial of God's law.

Predestination as presented by Thomas Aquinas is an aspect of God's absolute perfection as opposed to any kind of perfection in created being. The latter has the structure of potentially not being, so that individual defect is possible on any level within the order of the universe. The universe can be

conceived to be perfect even if it is not the case that each of its individuals is perfect in its own species. Positively, defect in created beings can contribute to the perfection of the universe as a whole in two ways: if the defect is merely a physical one it realizes inherent possibilities of individuation within a species; if the defect is a moral one, then the final execution of deserved retribution serves to glorify God's justice and eternal law. Now, moral evil as such is not caused by God but only permitted to happen, where the underlying act of will and any action resulting from it has God as first cause in as much as the evil act participates in being and goodness. This is always the case, since evil consists in purposefully preferring the goodness of lower things to the highest goodness of God's will and order. Evil as such, then, can be conceived only negatively, in terms of the absence of what ought to be. Acts, in contrast, participate in being. Thus in the background of this theory of predestination is an ontology of good and evil along the line of *ens et bonum convertuntur* ('being' and 'good' can be substituted for each other). Now, only God is identical with his being and act. So he cannot fail to be absolutely perfect. Created being, because it participates in being with the inherent possibility of not-being, can be perfect only in as much as it represents or imitates divine perfection.

In the subsequent history of philosophy, interest in predestination has decreased in proportion with the progress of anthropocentric thought and the dissolution of the bonds tying moral philosophy to metaphysical concepts dealing with the nature of the universe.

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MARTIN BECKER

Pre-Socratics

Definition and Doxographic Tradition. It is above all under Hegel's influence that the classification of Greek philosophy into periods has been carried out; for the ancients, groupings were made according to the succession of masters and students. Thus, for Hegel a new period begins with the Sophists, as they discover the subject. On the other hand, Eduard Zeller sees the decisive turning-point in the turn to the concept, which Socrates was the first to accomplish. The first major doxographic report on pre-Socratic philosophy is *Metaphysics* I, 3–5, in the context of a discussion of the four meanings of 'cause' as distinguished by Aristotle. After considering the material cause, claims Aristotle, the early philosophers discovered the origin of movement (or efficient cause), which in turn led to the final cause. The question of the essence was first posed with the Pythagoreans.

The writing of the history of philosophy with a systematic intent was advanced in the φυσικῶν δόξαι of Theophrastus (*c.* 372–*c.* 287 BC), on whom the entire subsequent doxographic tradition rests. Plato offers a starting-point for interpretation at *Phaedo* 99c, where Socrates says that, out of fear of blinding his soul, he abandoned the effort to grasp reality with the senses and instead fled to thought. According to Plato's critique, the pre-Socratics explain reality with the help of concepts that are tied to vision.

Following the Peripatetic Sotio of Alexandria (2nd century BC), Diogenes Laertius (3rd century AD) distinguishes between the Ionic succession, tracing back to Thales of Miletus (*c.* 624–*c.* 545 BC), and the Italic, founded by Pythagoras. Heraclitus is not assigned to any school.

The principal pre-Socratic philosophers were: Thales of Miletus, Anaximander (*c.* 610–547/6 BC), Anaximenes (6th cent. BC), Xenophanes (*c.* 570–*c.* 480 BC), Heraclitus, Pythagoras, Parmenides (and his disciple Zeno), Empedocles (*c.* 490 – *c.* 430 BC), Anaxagoras (*c.* 500–*c.* 428/7 BC), Leucippus (mid-5th century BC), and Democritus (*c.* 460–370 BC).

The Ionic Philosophers. According to *Metaphysics* I, 3, Thales regarded water as

the principle from which all things come to be and into which everything decays. His question, as well as his answer, traces back to myth. Thus 'water' ought not to be understood here as material in the Aristotelian sense. Thales's archaic thought does not yet have available the distinction between the matter and the cause of movement.

According to Anaximander, the *apeiron* is the principle of everything. This is the space that embraces everything else; it is filled with a material which is the inexhaustible supply of all that comes to be. Anaximander goes beyond Thales to the extent that he distinguishes this principle from the empirically perceptible elements. These two factors seek constantly to annihilate each other; thus, were either of them unlimited, then the other would have perished already.

For Anaximenes, the third Milesian, the different materials from which things come are simply air in various different states of aggregation. Thus, in as much as Anaximenes tries to explain all appearances through the quantitative concept of varying densities, he is a precursor of modern natural science.

The surviving fragments show Xenophanes above all as a theologian and critic of religion. These speak of a unique god, who is not to be represented anthropomorphically. Rather he might be conceived of as pure activity that would work in the world without thereby exerting itself or moving. In this concept of god the doxography sees an anticipation of the ontology of Parmenides and also evidence that Xenophanes had served as Parmenides's teacher. Especially important is the pseudo-Aristotelian work, *De Melisso Xenophane Gorgia*, where the god of Xenophanes is characterized via Parmenidean predicates and where the fact of his not having become and his uniqueness are proved with Parmenidean arguments.

According to *Metaphysics* I, 3, Heraclitus regarded fire as the material cause of the universe. This opinion finds a certain support in the fragments. Heraclitus's ontology, however, cannot be conceived adequately with the conceptual resources found in *Metaphysics* I, 3. The category of symbol is essential. The point is to grasp the sense expressed through and hidden behind the observable phenomena. Thus fire, which is both destructive and life-giving, incorporates the unity of opposites. It is a process subject to laws, in which the transcendent reason determining all appearances is manifested.

The Italic Philosophers. Of Pythagoras we know with certainty only that, influenced by the Egyptians, he taught the immortality of the soul and the transmigration of souls. The most reliable witnesses concerning his school are Aristotle, *Metaphysics* I, 5, and the fragments of Philolaos of Croton (fl. second half of 5th cent. BC); the other tradition of his thinking is strongly influenced by Plato. The cosmology handed on by them traces the world back to the two principles of the 'unlimited' (the even) and the 'limited' (the odd). Pythagoras's ontological thesis to the effect that "things themselves are numbers" (*Met.* 987 b 28), rests on the observation that numerical relationships underlie certain phenomena, as for example is the case with musical harmony. This presupposes that reality could be known only as mathematically structured.

For Parmenides of Elea, being has never come to be, is perpetual, one, unchanging, and perfect. Thus, Parmenides denies coming-to-be, passing-away, change, and difference. His ontology rests on the thesis that non-being cannot be thought and consequently cannot be. What is controversial is the issue as to which concept of being Parmenides proceeds from; primarily, existence and being as truth have been proposed. The solution ought to lie in the concept of thought, which Parmenides compares to verbs of perception: one who thinks, thinks being; he who does not think, thinks nothing at all.

As far as possible, natural philosophy after Parmenides seeks to hold on to his ontology, without – as he did – declaring the world of appearances to be a mere illusion. Generation and corruption are mechanistically interpreted as the mixing and separation of unalterable constituent parts. In Empedocles, earth, water, fire, and air are mixed and separated through love and hate. According to Anaxagoras, each material contains all the others; the world comes to be from a homogenous mass through a vortex movement

impelled by 'spirit'. The most influential effort to explain nature via an Eleatic is the atomism of Leucippus and Democritus.

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FRIEDO RICKEN

Privation

Privation has long been understood to be a kind of lack, a lack of what naturally belongs to a subject. It is a normative concept, making reference to the nature of the subject. Human nature, for example, requires sight, but not wings. Thus, the lack of wings is not a privation, but the lack of sight is. The normative force is to be found in the requirements of the subject's nature. A mere lack, unqualified by the requirements of some nature, such as a human's lack of wings, is known as a negation. Privation and negation were distinguished by Aristotle and the distinction was observed by his successors. In *Metaphysics* IV 2, Aristotle says:

> for negation means just the absence of the thing in question, while in privation there is also employed an underlying nature of which privation is asserted (1004a15; cf. 1022b22 and 1046a31).

This understanding of privation is nonmoral and arises out of a conception of the coextension of value and being. Since everything which is good has being, evil is identified with privation because privation is a lack of being. This, however, is not a moral sense of evil, since pain, bitterness of taste, and the lack of heat in water are all examples of evil on such a view. Moral evil is but one instance of the more general concept of privation. The chief historical sources of this view are Plato (*Rep.* 6, 509; *Phaedo* 77), Plotinus (*Enn.* I, 8.3), Augustine (*The City of God* IX, 9; *On the Nature of Good Against the Manichaeans* 31, 4), and the Pseudo-Dionysius (*On the Divine Names*, Chapter 4). Later important contributors include Anselm (*On the Devil's Fall*, Chapter 7), Thomas Aquinas (*Sum. Theol.* I, q. 48, 49; *Disputed Questions: On Evil*), and Francisco Suárez (*Metaphysical Disputations* XI, LIV).

The chief objection to the concept of privation is that, when identified with evil, it appears to make evil illusory, since privation, and hence evil, is a lack of being. This is an objection voiced by both medieval and contemporary authors. For the medievals, the question focused on the explanation of positive evil, evil which does not appear to be privative, such as pain, error, and avarice. Contemporary writers, especially in the existentialist camp, focus on the palpable reality of experienced evils such as blindness. Underlying these questions are both epistemological and ontological puzzles over the status of privation. How can privation be glaringly evident and in some sense real, while at the same time be unreal because of the absence of being?

A response endorsed by Suárez and Thomas Aquinas makes clear that the ontological status of privation is that it is an object of the mind (*ens rationis*) which has a foundation in reality, i.e., it refers to real entities. Positive evil they characterize as a privative relation between real entities. In neither author is there any denial of the reality of the experience of evil or a turn toward a subjectivism in which thinking something evil makes it so. At the same time, neither claims that evil itself has being, since it would then be good. Their middle course is to say that the referents of privation have being while privation itself does not.

Much of contemporary philosophy sidesteps the above questions by denying the normative conception of natures and the coextension of value and being.

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DOUGLAS P. DAVIS

Probabilistic Metaphysics. See: Metaphysics V

Process

Process, change, and event are the main ontological 'categories of becoming'. The category of process is used primarily to express a continuous dynamic character of reality, i.e., continuous activity, emergence, or transiency.

Process Philosophy. The earliest philosophical tradition which promoted the view that the category of process expresses the true nature of reality is Buddhism. Heraclitus of Ephesus, who held that the universe maintains itself as constant flux between opposites, was the first Western philosopher to develop a process-philosophical approach. In Western thought, the history of ontological schemes displays a strong bias against the categories of becoming. This can partly be explained by the influence of Christian thought; the reality of change was denied because it contravenes the immutability of God who, knowing of a genuinely changing world, would appear to change himself. More importantly, the disregard for dynamic notions can be said to result from the influential alliance between the categories of being (object (substance), attribute, fact) and the epistemological thesis that knowledge proper concerns eternal truths. Although Aristotle's notion of form (in particular as interpreted by Averroes) and Leibniz's notion of a monad address processual aspects of empirical reality, most traditional ontologies from Plato onwards downgrade dynamic features of appearance and relegate dynamic categories to the domain of opinion. Similarly, most contemporary ontologies neglect dynamical categories in so far as they have no straightforward representation within the 'canonical' logical frameworks (i.e., predicate logics) normally used for the philosophical reconstruction of knowledge claims.

Some of the philosophers who explicitly consider the notion of process accept the epistemological thesis that we can explicitly know only of items belonging to a static category (i.e., a fact or state of affairs), and stress that the 'exclusive fixations' of our common conceptual analysis of experience are inadequate for expressing what is dynamic. The true processual nature of reality is then either seen as being radically prior to, and thus inaccessible to, fully categorized reflective awareness (Henri Bergson, William James, Samuel Alexander); or it is declared to be cognitively accessible only from within a 'movement' of reflection about traditional categories which establishes their dynamic interpretation (Hegel).

Process philosophers of a second variety, however, reject the thesis that the dynamic aspect of reality is ineffable or such as to require a particular style of thinking. Some of these process thinkers consider it the task of process philosophy to introduce a new scheme of categories, in order to overcome the fixed oppositions of traditional 'absolutist' metaphysics. Here the idea of process is used to mediate between realms of being (e.g., inorganic and organic nature) that are traditionally separated (cf. C. Lloyd Morgan, *Emergent Evolution*, 1923). The most speculative forms of process metaphysics undercut the traditional nature–spirit dichotomy by stipulating that whatever belongs to reality is constituted by atomic processes which are modelled on feelings (Charles S. Peirce, "The architecture of theories", 1891; Francis H. Bradley, *Appearance and Reality*, 1893; Alfred N. Whitehead, *Process and Reality*, 1929; Charles Hartshorne, *Man's Vision of God*, 1941). In Whitehead's 'philosophy of organism', these constituent 'feelings' introduce a valuative dimension into all forms of being and manifest divine creativity; this aspect has stimulated the development of process thought in theology. Peirce, on the other hand, postulates as the initial character of the universe an 'unpersonalized feeling'

which by a process of evolutionary selection is transformed into the natural regularities described in scientific laws.

Other process philosophers of this second kind hew more closely to the methodological approach of contemporary analytical philosophy; they try to accommodate the categories of becoming within ontological schemes that explicate the logical structure of conceptual frameworks employed in science and common sense. (Paul Weiss, *Reality*, 1938; Andrew P. Ushenko, *Power and Events*, 1946; Roman Ingarden, *Time and Modes of Being*, 1964; Wilfrid Sellars, "Foundations for a metaphysics of pure process", *The Monist*, 1981.) The following considerations focus on this properly ontological strand of process thinking.

Accounts of Process. Taken in its wide sense, the notion of process refers to any change, whatever its complexity and structure (a sneezing, a waltzing, the Industrial Revolution). On-goings in this general sense, which in Aristotelian metaphysics are characterized as "actuality of potentiality as such" (*Phys.* III, 1), may be defined extensionally as follows:

> *p* is a process if and only if p is continuant in space and bounded in time, and the same parts of *p* cannot be at the same place at different times (cf. E. Zemach, 1970 "Four ontologies", *Journal of Philosophy* 67, 231–47).

In its narrow sense, the notion of 'process' demarcates a certain *type* of change as contrasted with events. For some authors the category 'event' applies to instantaneous changes while 'process' characterizes a temporally extended development (e.g. Ingarden, op. cit.). Recent work in verb semantics has seized on elements of Aristotle's distinction between 'activities' and 'movements' (*Met.* IX, 6) in order to classify processes, as 'homeomerous' happenings which, unlike events, have no structure or internal development (A. Mourelatos, 1978, "Events, processes, and states", *Linguistics and Philosophy* 2, 415–34). Rather, in analogy to masses, processes are considered to be spatio-temporally extended entities whose spatio-temporal parts are 'qualitatively' the same as the whole entity itself (e.g., running, buzzing, spinning) (E. Bach, 1986, "The algebra of events", *Linguistics and Philosophy* 9, 5–16). Due to homeomerity the logical properties of processes suggest a formal representation in terms of mereological relationships (cf. P. Simons, *Parts*, 1987).

Motivations for Process Ontology. There are several reasons for introducing 'process' (in either the wide or the narrow sense) as a basic category in ontology.

First, if philosophy is to evolve an ontological framework able to integrate the basic categories of the sciences, it must deal with the fact that contemporary physics (e.g., quantum field theory) seems to postulate dynamic entities as the ultimate constituents of matter that apparently cannot be accommodated within the traditional substance-ontological scheme. Furthermore, the aspect of dynamicity involved can be articulated neither in terms of a sequence of facts nor in terms of an object's having at different times mutually exclusive properties.

Second, the process category is not strictly dependent on the category of object or substance: not only in scientific theories but also within our common-sense framework there are 'absolute processes' which cannot possibly be considered to be the dynamic accidents of any underlying substance (C. D. Broad, *Examination of McTaggart's Philosophy*, 1933; Sellars, op. cit.). On the one hand, absolute processes, which are often expressed by sentences with impersonal subject (e.g., 'it is thundering'), may be causally produced by changes in objects (e.g., masses of air colliding) but do not spatio-temporally coincide with them; thus they cannot be treated as qualitative or relational dynamic accidents of the objects involved. On the other hand, absolute processes cannot be conceived of as relations or facts, since they have spatio-temporal location, move, change, and are causally efficient.

Third, as Donald Davidson has argued, in order to give (within predicate logic) an analysis of the logical form of sentences with adverbial modifiers (in particular, to explain inferences that involve 'adverb dropping'), one must quantify over happenings; given W. V. O. Quine's quantificational criterion for ontological commitments, this amounts to

accepting dynamic entities in one's ontology. There are competing semantic analyses of 'adverb dropping' which circumvent quantifying over dynamic entities (e.g., P. Roeper, 1987, "Principles of abstraction for events and processes", *Journal of Philosophical Logic* 16, 273–307). These proposals explain at best inference relations among sentences about 'subject-based' processes (e.g., Herodotus's journey to Egypt), not, however, inferences from sentences about absolute processes.

Fourth, even assuming that all processes have substances as substrata, object-geared ontology has difficulty in accommodating persistence through change, in particular the unity of a living organism. In order to explain how one and the same thing can at different times have different properties (being bent vs. being straight, being a tadpole vs. being a frog), one must either assume that

1. objects have time-indexed properties *F*-at-*t*, or stand in a relation to properties and times; or
2. the change in question consists in a rearrangement of the constituent particles; or
3. things are compounds of space-time slices.

None of these alternatives is attractive. The first option is committed to ascribing to an object a time-indexed property or relation at a time when it has not yet displayed this property or relation; if I am bent at t and straight at a later time t' then, in order to remain identically the same at all times of my existence, I must at all times of my existence have the property being-straight-at-t' or stand in a relation to straightness and t'. But this amounts to a commitment to metaphysical determinism. The second two alternatives pose particular difficulties for a definition of the unity of the object.

Tasks of Process Ontology. Perhaps the most important task for those who would wish to promote 'process' as a basic ontological category is that of specifying the relationship among process, time, and tense in a way that complies with the following three requirements.

1. The account of time chosen must warrant that objective becoming is continuous because only on the basis of this thesis can processes be claimed to be, first, categorially irreducible and, second, unaffected by Zeno of Elea's paradoxes of motion.
2. If processes are to be objects of human experience, the relationship between time and tense must be specified in such a way as to allow for a synthesis of the continuous durationless present of the objective world and the discontinuous durational 'specious present' of a subject.
3. Process ontology is committed to the claim that processes are basic *concrete* individual constituents of reality, i.e., are at least spatio-temporally extended and causally efficient.

Thus, the time–tense framework must be designed to resolve the conflict resulting from our intuitions that processes *qua* concrete entities seem to 'exist' only while going on or taking place and yet are said to be extended in time.

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JOHANNA SEIBT

Proclus

Life and Works. Proclus was born in Constantinople, of a prosperous pagan Lycian family from Xanthos, around 410 AD. His father, a lawyer, sent him for higher education to Alexandria, with a view to his following him into the profession. However, a visit to Constantinople around 430 seems first to have turned him towards philosophy,

and shortly afterwards he set out for Athens to pursue the deeper truths of Platonism.

In Athens, he attached himself to the aged Plutarch, until Plutarch's death in 432, and then to Syrianus, who died in 437, but who had a decisive influence on his thought. Proclus himself became head of the academy at Athens after Syrianus, presiding over it for almost fifty years, till his death in 485.

During this time he turned out a prodigious body of work, most of which survives, at least in partial form. His most important works are a series of commentaries on Platonic dialogues. We also have three systematic works: two, the *Elements of Physics* and the *Elements of Theology*, relatively early; while the third, the *Platonic Theology*, a vast synthesis of Neoplatonic metaphysics and theology, is certainly late. A number of monographs, on providence, fate, and the problem of evil, previously known only from the Latin translation of William of Moerbeke (*c.* 1215–86), have recently been recognized as being preserved in Greek, plagiarized by Isaac Sebastocrator.

Philosophical System. Much of what currently passes for Proclus's philosophy is really to be ascribed to his master Syrianus, and even to Syrianus's spiritual master, Iamblichus of Chalcis; and indeed Proclus does not try to disguise his indebtedness. However, he must be given credit at least for synthesizing and organizing later Neoplatonist doctrine.

The first principle of Proclus's system, common to all Platonism, at least from Plotinus on, is the derivation of all reality from one simple cause, itself absolutely unitary. How this comes about is a problem basic to Neoplatonic metaphysics, explored in the opening propositions of the *Elements of Theology*. Arising from this is the principle of *cyclic creativity*, linking causes to their effects, in a cycle of *progression from* (πρόοδος) and *reversion upon* (επιστροφή) a higher principle, which itself remains *at rest* (μονή). This in turn involves the doctrine of *participation* (μέθεξις), which sees each level of being as having 'unparticipated-in', 'participated-in', and 'inherent' aspects, according as the level of being below it participates in it and absorbs something of it into itself. Resulting from this process is a relation of potentiality and actuality linking higher and lower entities. Already for Plotinus, the One is the "potency of all things" (δύναμις πάντων, *Enn.*, V 1, 7, 9), where the two kinds of δύναμις, potentiality and "(creative) power" are fused. So it is for Proclus (except that he exempts the One even from being a δύναμις, *Plat. Theol.* III 9); lower entities bring to actuality the higher, while never, of course, attaining equality with them: intellect, for instance, can be taken as an *actualization* of the One.

As regards levels of being, later Neoplatonism instigates a proliferation of subdivisions or 'moments' of each level, generally in the form of triads arranged according to the sequence 'being-life-intellect'. On the level of the One, however, the chief innovations are a system of 'units' (ἑνότης), unitary foreshadowings of the Forms, and above them the pair Limit and Unlimitedness (derived ultimately from *Philebus* 23 c ff.). The 'units' perform the function of linking the One with the multiplicity of the noetic realm, being the 'participated' aspect of the unitary real (*Plat. Theol.* III). Each lower realm is actually presided over by a unitary element, connecting it with the realm above. All of this fulfils what E. R. Dodds has termed 'the principle of plenitude', according to which the world exhibits no 'gaps', or sudden transitions of level.

As for intellect, the Plotinian hypostasis of *Noûs*, in which Porphyry had already distinguished a triad of being, life, and intellect proper, and which Iamblichus had divided into an 'intelligible' (νοητός) or 'objective' and an 'intellectual' (νοηρός) or 'subjective' realm, each of which was triadically distinguished, was further filled out by Syrianus and Proclus by the insertion of an 'intelligible-and-intellectual' realm, and the dividing of each of the triads into further triads, on the basis of the 'being-life-intellect' distinction (cf. *Plat. Theol.* V).

The Platonic figure of the Demiurge suffers a similar triadic proliferation (cf. *In Tim.* I, 99–319). He is identified with the intellectual realm, and divided into seven, each of which is a triad.

Soul, or the psychic realm, is similarly

divided (cf. *Plat. Theol.* VI, *El. Theol.* props. 184–211). Presided over by its proper monad, Unparticipated Divine Soul, it is divided into the immanent World Soul and a host of individual souls, divine (planetary), daemonic, human, and irrational. Below Soul, Proclus, like earlier Platonists, recognized the level of Nature (*physis*), which is soul in its lower, irrational aspect, imparting life and motion to the physical world. It is Nature which most immediately informs Matter, which for Proclus is *not* the source of evil, but simply the lowest manifestation of the Good, which is the One.

Influence. Proclus's influence has been very great on various strands of the Western philosophical tradition, from Dionysius the Areopagite (1st century AD) and John Scottus Eriugena, through Thomas Aquinas and Nicholas of Cusa, to Spinoza, Hegel, and F. W. J. Schelling (1775–1854). His *Elements of Theology*, initially disguised as the *Liber de Causis*, was a basic text in the later Latin Middle Ages. He may be regarded as the father of the systematizing tendency in idealist philosophy.

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Property. See: Attribute

Proposition
I: History and Systematic Role

Proposition is a technical concept, primarily used in logic and the philosophy of mind. It refers to what is thought or said, as distinct from what is thought about or spoken of, on the one hand, and from the act or process of thinking or speaking on the other. It is also to be distinguished from sentences. Unlike what is thought, sentences are always of a specific language. Moreover, the same sentence, e.g. 'The head of our government is a woman', can be used to make different statements (express different thoughts), so that what is said or thought is different, even though the sentence is the same (Strawson 1950, pp. 110ff.).

In English the proposition is closely associated with 'that . . .' clauses, but a similar point holds for facts. Some have attempted to identify propositions with facts, or at least to treat facts as true propositions. The general identification does not seem possible, since false propositions can plausibly be regarded as propositions to which no uniquely correlated fact corresponds. Further, facts do not have semantic features, while propositions certainly do. The fact of the glass being on the table is not true or false, and is not about, of, or intentionally directed upon anything as is the proposition that the glass is on the table (Russell 1956, pp. 178–89).

In the history of Western philosophy the proposition clearly emerges as the λογος of Plato's *Sophist* (261–4) and *Theaetetus* (190 a 4–6). In the related but much more complex terminological framework of Aristotle's writings, δόξα is on the whole preferred over λόγος, though λόγος and its variants are common, along with other terms such as ὑπόληψις (Nuchelmans 1973, pp. 23–44). Aristotle also develops an elaborate terminology for the linguistic acts and signs through which the proposition is expressed. The Old Stoa, deriving from Zeno of Citium, selected the term πρᾶγμα to refer to what is thought (of or about a certain object). A 'complete and independent' πρᾶγμα is an ἀξίωμα, which, when put into words yields a λεκτόν (Nuchelmans 1973, p. 75). The literary remains of the Stoic logicians are sadly incomplete (Long and Sedley 1987, pp. 195–212), but in many contexts λεκτόν and ἀξίωμα clearly are used interchangeably for the theoretical purposes at hand. In these discussions from antiquity, most of the later systematic problems about the precise nature of 'propositions' – especially those concerning their ontological status and their relationships to minds, language, and society – emerge with force (Mates 1961, Chapters II and III; Nuchelmans 1973, Chapters 1–5).

The Latin term *propositio* seems to enter the history of logical discussions with Cicero (106–43 BC), who uses it to refer to the major premiss of a syllogism. Its general sense of any statement or meaningful sentence is present in the *Peri Hermeneias* of Lucius Apuleius (2nd century AD). The history of *propositio* in the medieval period is covered in Nuchelmans (1973) and in Moody (1953) (see also Kretzmann 1970). There is no adequate historical account of 'propositions' and its equivalents in the modern and contemporary periods, but see Castañeda (1987), Gale (1967), Prior (1976), and Willard (1984).

There are three main theoretical needs which propositions are invoked to meet, and which serve as guidelines to their nature: the need for something to which truth, falsity, and other semantical and logically syntactical properties belong, the need for entities that can serve as terms for logical relations such as implication and contradiction (and thus be the ultimate subject matter of the science of logic), and the need for a range of determinations that can characterize mental or linguistic acts, and acts of consciousness in general, with respect to their intentionalities. The theoretical motivations for integrating these three desiderata around one type of entity, the proposition, are very strong; but the problems are great, and are heightened by general philosophical issues which come to bear upon the nature of propositions. Are propositions, as that which meets the theoretical needs mentioned, mental or physical? Are they universal and abstract entities (Willard 1984, Stalnaker 1976), or particular and concrete? Are they essentially objects of mental and linguistic acts, or are they constituents or characteristics of such acts, or identical with such acts?

The fundamental ontological issue concerned in all of this is that concerning the nature of the unity in the mental act. Numerous 20th-century writers have tried to think of propositions as simply the objects or 'accusatives' of propositional attitudes such as belief, fear, deciding or thinking that . . . However, it remains unclear whether these attitudes and acts should be called propositional because propositions are their objects – as grammar might suggest: 'He believes that his car has been stolen', 'He told Tracy that his car has been stolen', etc. – or because propositions are ingredients in the attitudes and acts, thereby conferring their intentional or semantical characteristics upon them. The former explanation has been most favoured in the literature; but it faces the problem of how the act selects the particular proposition to be its object, a problem which seems quite unsolvable. A dual objectivity, from act to proposition and from proposition to object, creates more problems than it solves. But if the proposition is treated as a characteristic of the act, taking it as the act's intentional quality of being about a certain situation or state of affairs, some of the difficulties are resolved, and propositions are located within a familiar ontological pattern, that of subject and property, which allows them to retain their unique character as a distinct range of qualities, the intentional. This also offers certain advantages in developing a theory of propositions that can cope with indexicality (Castañeda 1987). If we further treat propositions as true universals, they and their characteristics can be identified with the semantic features of mind and language, and the peculiar epistemic status of the laws of formal logic can be understood as reflecting the categorial meaning structures with which they deal (Husserl, 1970, *Investigations* I and IV).

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DALLAS WILLARD

Proposition II: The Propositional Bond

In the *Treatise*, David Hume wanted to do for ideas something like Sir Isaac Newton had done for bodies in his *Principia*. Newton had assigned to each body a quantity, the body's mass. Two bodies are of the same mass when one must push them equally hard to change the speed or direction of their motions equally. Newton's second law of motion says that $F = ma$; this means (among other things), that a body's mass is the constant rate of exchange between forces exerted on, or by, the body and the corresponding accelerations (changes in speed or direction of motion) undergone by the body. Newton's law of gravity is the law of a special force between bodies. It says that between any two bodies, there is a force of attraction whose strength varies directly with the product of their masses but inversely with the square of the distance between them. These two laws are the main elements in Newton's explanation of Kepler's laws of the motions of the planets about the sun, and thus of the unity of the solar system.

Where Newton has mass and distance as basic quantities, Hume has only association. Hume assigns no quantity remotely like mass to ideas; he has no criterion of identity for vivacity like Newton's criterion for equality of mass. Hume has no single framework for relations between ideas like the absolute space in which Newton placed bodies, so Hume has no quantity remotely like Newton's distance between bodies. So it is hardly surprising that Hume can state no laws for the association of ideas remotely like Newton's second law of motion or his law of universal gravitation. It is fair to say that by the standard of *Principia*, Hume's associations between ideas are all *ad hoc*.

Moreover, Hume does not even have a standard term of art for the unities or systems in which ideas associate. One might distinguish mental phenomena, like *thoughts* denoted by a noun phrase 'the thought' or 'Fred's thought' followed by 'that' followed in turn by a sentence, from *ideas* expressed by, say, the individual words in such a sentence. Perhaps ideas are to thoughts as words are to sentences, or atoms are to molecules, or the sun and planets are to the solar system. Not all collections of ideas will associate in a single thought; there is no thought whose constituent ideas are just those expressed by 'Socrates', 'is bald', and 'water'. So on an atomistic conception of thoughts and ideas, there seems to be a real question about why some ideas can associate in thoughts but others not. Note that facts too share this 'that'-plus-sentence notation. So one who places thoughts in the mind and facts in the world, and who pictures minds as mirrors of nature, might expect there to be laws of reflection relating the systems of thought and of fact. Yet since Hume does not even have a term for thoughts as distinguished from ideas, he cannot even raise these questions.

Kant certainly distinguished between judgements and concepts, and much of his critical philosophy is given over to an examination of the synthesis of judgements. In this examination, Kant seems to conceive unity on the models of whole and part or of subject and predicate. But since new branches can be grafted on to old trees, the first model seems inadequate to account for the distinctive completeness of a thought. The unity of a sentence is too perfect an image of the unity of a thought to yield much insight, and it would be an anachronism to read much of

recent obsessions with language into Kant's use of 'subject' and 'predicate'. Moreover, Kant characterizes concepts as rules for the synthesis of judgements. This characterization not only more encapsulates than solves the problem of synthesis; it also assimilates concepts to rules, which are too complete and sentential to be genuinely more basic bits from which thoughts could be enlightening synthesized. The problem of unity, a version of the ancient problem of the one and the many, became a, if not the, central problem for the absolute idealists in Germany (Johann Gottlieb Fichte (1762–1814), F. W. J. Schelling (1775–1854), Hegel (1770–1831) and later in England (T. H. Green (1836–82), F. H. Bradley (1846–1924), J. M. E. McTaggart (1866–1925). This was not only a problem of the unity of thoughts, but also of the self (again from Hume through Kant), and of whether there is or even must be an explanatory system of nature. But throughout, whole and part, or subject and predicate, seem to remain the dominant models of synthesis.

In this context, Gottlob Frege's introduction of functions into philosophy can seem like a breath of fresh air. He begins with a primitive distinction between functions and objects. An object is anything denoted by what he calls a proper name, or what we would now call a singular term; so 5 and the present queen of England are objects. His metaphors for functions are that they are incomplete and unsaturated (like radicals in chemistry): when the cube function is completed by the object 3, its value is the number 27. Frege then generalizes to make logic out of the mathematical distinction between functions and arguments. When singular terms are deleted from a sentence, what remains is a predicate. Predicates, he says, refer to functions of a special sort he calls concepts. (But he thought concepts are not mental, and can be grasped, as he put it, by this or that thinker; in this independence from us and from objects that, as he puts it, fall under them, they are like Plato's Forms.) Among the objects, there are two special ones, truth and falsity, that Frege called the truth values. Then, he explains, a concept is a function whose value is always a truth value, and he thinks of an indicative sentence as a singular term denoting the truth value that is the value of the concept denoted by its predicate at the objects denoted by its singular terms (though he is clear that there can be many ways to segment a single sentence into predicates and proper names). In the evaluation of functions at arguments then, Frege seemed to have a fresh conception of the nature of the propositional bond. (Philosophical German has only the single word '*Satz*' where in English jargon one distinguishes between sentences and propositions. Frege used '*Gedanke*' rather as 'proposition' is now used, but his anti-psychologism can make 'thought' a misleading translation for '*Gedanke*'. So where Kant might have spoken of the synthesis of judgement, propositional bonds might be a better metaphor, from chemistry, to offer Frege.) It is interesting that, writing to Giuseppe Peano (1858–1932) on 29 September 1896, Frege said that it is not accounting for communication, but only for inference, that requires analysis into concepts and objects. It is not obvious that Frege thought of concepts and objects as like atoms that can be extracted from molecules in which they figure; could there be English words if there had never been English sentences? Perhaps the proper question is not so much what binds ideas in thoughts as how ideas are abstracted from thoughts; or perhaps ideas and thoughts are sufficiently interdependent that neither question is proper.

The cube of 4 is 64; 4 is the successor of 3. So the cube of the successor of 3 is 64. That is, because '4' and '3 + 1' have the same reference, substituting the second for the first in '$(4)^3$' preserves its reference. But because 'Socrates' and 'the husband of Xanthippe' have the same reference, substituting the second for the first in the truth 'Socrates taught Plato' preserves its truth, though not its meaning and thus, in one sense, the proposition it expresses. It was probably to bring out the similarity between these inferences that Frege took sentences to refer to truth values. None the less, some, like Michael Dummett, regard this doctrine as the single greatest flaw in Frege's system. Sentences, says Dummett, are no sort of singular term at all; they are not used to

name, but to assert, suppose, and so on. Bertrand Russell felt something of this disquiet. The values of Frege's concepts are truth values, but the values of Russell's propositional functions are propositions. So Russell, as it were, hangs on to the idea that sentences denote (or 'express') things, but discriminates them much more finely than does Frege; in this way, Frege is more extensional than Russell. Frege's logic had foundered in contradiction. To preserve enough strength in the logic for mathematics to remain reducible to it, but to weaken it enough to ward off contradiction, Russell devised his theory of types of propositional functions. This theory required him to be able to recover propositional functions from the denotations of complex notations, like class abstracts, of which predicates expressing such functions were only proper parts; that requirement pushed him in intensional directions.

Frege's and Russell's (at least up to *Principia Mathematica*) primary philosophical concerns were with the epistemology and metaphysics of mathematics. Regimenting language was only a propaedeutic to logic for Frege, and Russell was only forced very slowly and reluctantly to talk much about words. It is perhaps only with Ludwig Wittgenstein's *Tractatus* that questions about the relations among language, thought, and reality are raised for their own sake; perhaps it is here that philosophy of language begins.

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W. D. HART

Proprietates Terminorum

Since the 12th century the scholastic authors were interested in the analysis of certain syntactical and semantical properties of denoting terms as these appear in propositions. The syntactical analysis nowadays can be reproduced by the tools of standard logic or by a Montague grammar; the semantical one, however, contains some ideas typical of Aristotelian philosophy.

It was with the 13th-century logicians Peter of Spain (1210/20–77) and William of Sherwood (*c.* 1200/10–*c.* 1266/71) that there began the scholarly elaboration of distinctions between the diverse functions of the terms in propositional contexts. These distinctions involve a catalogue of the principal variations of meaning and reference of the terms and a series of typical examples. These examples were used to prove the adequacy of the 'rules' making up the theory.

In the course of time – until about the 15th century – the complexity of the contexts grows: not only categorical propositions but also propositions with relational, tense, and modal particles were used as examples by the scholars. The general characteristics of the theory can be resumed in the following way:

1. A distinction between meaning (*significatio*) and reference (*suppositio*).
2. Admission of a multiple denotation of general terms.
3. Rules for the elimination of quantifiers ranging over a universe of Aristotelian individuals (substances and accidents).
4. A distinction of opaque contexts, whether created by self-reference or by the occurrence of intentional or modal particles. In these contexts the usual reference of terms changes.

In spite of a certain parallel to the ideas of Frege in his "Über Sinn und Bedeutung" there exist, apart from 2., notable differences: thus for proper names the *significatio* and *suppositio* coincide. Furthermore, scholastic philosophers did not accept the principle of compositionality to the effect that it is the reference of each constituent term which determines the reference of the whole. The

reference always depends on certain types of contexts and on intuitive entailments between them. Finally they accepted that the reference of a term is extended to merely possible objects. Other properties of terms are hereby created, to be inserted between *significatio* and *suppositio* – properties such as *ampliatio, restrictio, diminutio*, and *appellatio*.

Thus for example in the sentence:

(1) It is possible that some man is white

the reference of 'man' is extended (*ampliatio*) to the set of possible men. In the sentence:

(2) All ravens are necessarily black

the reference of 'black' is restricted (*restrictio*) to the set of all substances which are necessarily black. These discussions are reflected by the treatment of the modal syllogism, which can in this way be assimilated to the assertoric one. On the other hand these discussions cause certain ontological difficulties, since a compound of substance and accidents appears always to be contingent.

In the sentence:

(3) On the wall there is a painted man

the particle 'painted' exerts a modification (*diminutio*) of the meaning and therefore the reference of the term 'man'.

The expression '*appellatio*' had been used to express two different semantical properties: the existence of an object denoted by the term (this property was also called '*copulatio*' by certain authors) and the modification of the reference due to a modification in the habitual meaning. In this last case the term modified by the *appellatio* does not refer to the object but to the abstract property which constitutes the meaning of the term. Consider the following fallacies:

(4) Suppose that all white things are sweet and that Socrates sees something white. Then Socrates sees the sweetness.

According to the scholastic analysis, '*videt album*' does not mean a relation of a subject to an object which possesses the property of being white only incidentally. *To see something white* is analysed rather as a triadic relation between a subject, an accident, and an object possessing this accident. Therefore the most approximate meaning would be 'Socrates sees the whiteness of an object.' And this is the reason why the conclusion: 'Socrates sees the sweetness' is not acceptable.

The following example shows that this is not an idiosyncratic question of Latin:

(5) To die without pain is to die.
Socrates wants to die without pain.
Ergo Socrates wants to die.

The term 'to die without pain' in the context 'Socrates wants . . .' refers not to a fact but to a property. This scholastic analysis shows the proximity to Gottlob Frege's dictum that reference in intensional contexts points to the meaning and not to the habitual object.

A commonly discussed example is:

(6) I promise you a horse

where the term 'horse' occurs opaquely. The discussions centred on the type of supposition of this term. Nominalists such as William Ockham and John Buridan tried to explain (6) by an instantiation of the type:

(7) I promise you (this horse or that one or that one, and so on)

and argued that the reference of the term 'horse' in (6) is indeterminate (*suppositio confusa tantum*). Anti-nominalists like Walter Burley (*c.* 1275–*c.* 1344) insisted that this strategy did not propose any concrete object of reference and that therefore in order to explain the truth of (6) we have to look for abstract objects. In this case the term 'horse' would refer to a property. But it is not clear what it means to promise a property.

Leaving aside questions of detail, the scholastic controversies as to the properties of terms focused on the possibility or impossibility of reducing abstract to concrete entities. William Ockham and John Buridan thought that it is necessary to reduce the

significatio to the *suppositio*. The argument used in William's *Summa Logicae* (I cap. 33) is partially identical with Rudolf Carnap's reconstruction (1947) of intensions in terms of extensions in possible worlds. But to reduce abstract universal properties William uses the Aristotelian theory of individual accidents (Dufour 1989).

The scholastic theories of the properties of terms form a fragmentary meaning-theory which depends on two presuppositions: the acceptance of the analysis of elementary propositions required by syllogistics and the acceptance of the Aristotelian ontology. It is interesting to see how these two presuppositions make themselves manifest in a theory of language, but the theory of the *proprietates terminorum* is otherwise of mainly historical interest.

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CARLOS A. DUFOUR

Protagoras

Protagoras of Abdēra, a Greek colony on the Aegean coast of Thrace, was born not later than 490 BC and probably died soon after 421 BC. Statements that he was a pupil of the atomist Democritus are probably later fictions as Democritus was some thirty years his junior. Protagoras was the most famous of all the 5th-century Sophists, and Plato suggests that he was the first to adopt the name of Sophist and to charge fees for the rhetorical instruction which he offered. He travelled extensively throughout the Greek world, but was best known at Athens where he had the support and friendship of Pericles (*c.* 495–429 BC). An incomplete list from the 3rd century AD mentions twelve titles of works composed by him. The two best known were entitled *Truth* and *On the Gods*, but all that survives is a bare handful of brief quotations and we depend for information on his doctrine upon summaries and interpretations by Plato, and briefer statements in Aristotle, Plutarch (*c.* 46–*c.* 120), and Sextus Empiricus (*c.* 150–*c.* 225). The most famous and controversial of all his doctrines is his Man-measure statement, apparently standing at the beginning of his *Truth*, in words which were ambiguous already in antiquity: "man is the measure of all things, of those that are, how (or that) they are and of those that are not, how (or that) they are not". Plato in the *Theaetetus* treats this primarily as a doctrine about sense-perception as experienced by each man individually. When a wind blows to some it seems hot and to others cold, and it *is* hot for those to whom it seems hot, and cold for those to whom it seems cold. It follows that all perceptions are true. This has led in modern times to three different interpretations:

1. All perceptions are true for every individual because it is a fact that he does experience his own perceptions. But his perceptions are merely subjective to himself and do not exist externally – there is no externally existing wind.
2. Individual perceptions are causally induced by features not necessarily like what is perceived, but which are truly present in external objects.
3. All perceptions are true because all perceived qualities are actually present in the external object, and differences in perception are due to selective factors in the individual.

This last view, implying the co-presence of opposite qualities in objects, would relate Protagoras more closely with earlier pre-Socratics such as Heraclitus and Anaxagoras (*c.* 500–428 BC). Of special interest is the application of this doctrine to moral and aesthetic predicates. He seems to have held that whatever seems just, is just for the man or city to whom it seems just. But Plato at least suggests that he may have regarded some views of what is just as bringing greater

advantages (objectively) to cities and individuals than other views, although all such views will be equally true. Probably related to the Man-measure doctrine is his contention that concerning every matter there are two opposed doctrines or arguments, perhaps taking the form that it both is and is not, e.g. hot and cold, just and unjust, and that the function of the Sophist is by the power of rhetorical argument to teach students how to make one view stronger or more persuasive than the other. This doctrine of two opposing arguments was known technically as ἀντιλογική (the art of contradiction). At the same time Protagoras was credited with holding the view that contradiction was impossible, a doctrine found in other Sophists, above all with Antisthenes. It seems to have rested on a doctrine of meaning according to which only those statements can have meaning which refer to something which is actually the case. If two apparently opposing arguments are both meaningful they must be so because they refer respectively to two different states of affairs, both actually the case, and because of their difference in reference they cannot actually constitute a contradiction. In the dialogue *Protagoras*, Plato ascribes to the Sophist partly in the form of a stated myth the doctrine that all men come by education to possess qualities of mutual respect and a sense of justice or what is right, and that these attributes are the necessary condition for all human societies. It is because all men share in these, not necessarily equally, that it is appropriate, as the Athenians themselves thought, for all men to be given the opportunity to express opinions on matters of public policy, a view sometimes acclaimed as the first theoretical justification for democracy. Of course, while for Protagoras all views about what is fair and just will be equally true, some will be better than others and it is the function of the Sophist to help citizens to substitute better opinions for those that are worse. In his treatise *On the Gods*, Protagoras said that he could not tell how (or that) they are or are not. This led to his prosecution and condemnation for impiety and a reputation for atheism. More probably here as elsewhere he was expressing agnosticism on matters which were not subject to direct perception, and this would accord with his general position which today would probably be classed as a form of phenomenalism.

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GEORGE B. KERFERD

Psychology

The investigation of ontological questions relevant to particular sciences turns on our capacity to attend to the unexamined assumptions upon which both the theorizing and the empirical practices of the sciences depend. What does psychology as it is or might be practised take for granted about the kinds of entities there are in the world? To begin the investigation it would be advisable to start with a brief sketch of a piece of psychological research as an illustration of how the programme of the investigation of a common given phenomenon has developed. I will take the development of research into memory as my example. The first point to notice is that the very terms in which I have expressed the idea of this research project already contain an implicit ontological step. The project is described as the search into memory, a substantive, but in the real world of human activity there are people remembering, doing something. Memory is an abstract entity standing in for a variety of processes and activities. Sometimes this tendency towards the creation of abstract objects is harmless. But in certain branches of psychology, in particular, the study of emotions, it has had a seriously deleterious effect. At the outset then, I will move directly to a processual or activity view of the subject matter of psychology. So my first ontological recommendation will be to eschew abstract

entities and try as far as we may to express the topic in terms of activities, things that people do. So, it is people remembering with which we should be concerned.

Classical studies of remembering are centred around the phenomenon of recollection. They take the form of the presentation of what are still sometimes called stimulus objects in various combinations and temporal distributions. Subjects, as they are called – that is the people involved in the experiment – are asked to carry out certain tasks, in particular to try to recognize the type, order, and temporal distribution of the objects that are on show, that are supposed to have been perceivable at some past time. Out of these developments have come a series of interesting observations on the number of objects one can recollect, on the effect of lapse of time on recollection and so on. All this work was begun by Hermann Ebbinghaus (1850–1909) and has continued in much the same vein to the present day. Much has been found out about the individual capacity for recollection. Now it is worth noticing that not only is this programme based upon the idea of the psychology of remembering as the investigation of an individual capacity, but it also classically presupposes a subjectivist conception of what recollection is. The reports given by the people involved are not themselves the object of investigation, they are taken *au pied de lettre* as authentic reports of what someone has experienced. Recollection then is individual and subjective. So far, so good. But, is that remembering?

When we turn to everyday life, to look at the phenomenon of remembering therein, the way in which the thoughts that are our recollections are introduced into the public conversation and there dealt with, comes to the fore as a topic of immense interest. The performative utterance, 'I remember that so and so', is a conversational intervention and as such is a contribution towards what is essentially a social process. Incidentally, in the investigations of the conversational activities of *The family* that served as the subject for the BBC programme of that name, Marga Kreckel noticed that there is in general a disparity between claims to have recollected and the acceptance of those claims as the basis for the authentication of a recollective past event as part of the working past of some social group. I say 'working past', because how the group continues to live in the future depends in part in what it believes itself to have done in the past. Marga Kreckel showed that the claims to authentic recollection were accepted by the family more on the basis of the social location of the individual who made the claim than on any apparently empirical ground for its authenticity. As a matter of fact, it is extremely difficult to prove, as one might say in the archaeological frame, what happened to oneself in the more or less immediate past. It is a cliché that people find the reading of their last year's diaries astonishing. So, the authentication of recollections is not generally achieved by assembling empirical evidence of what occurred. On the contrary, it is achieved by a social process of negotiation, so power and status enter into the matter intimately. In *The Family* the mother had memory rights and in general delivered verdicts that were by and large unfavourable to the recollections of the lower-status members of that family.

Reflecting on this complex and developing research programme into the human activity of remembering suggests that at least a dual ontology is called for. The phenomenon of remembering as a process or activity is embedded in two separate but interacting realities, interacting through the production of speech elements which link experiential matters, such as recollection with social matters, such as claims. The dual ontology is then on the one hand individual and subjective, and depends upon the idea of mental events, but on the other hand it is public and social and depends upon the idea of a conversational matrix constructed of speech acts. Matters have not rested there. By and large the research programme involving the study of remembering has concentrated on the alleged mental events. Attention to these with their intimate relationship to individual physiological processes, has led to a proliferation of extraordinarily interesting research into the neurochemistry and neurophysiology of long- and short-term memory. A great deal has been learned about the processes that are involved in recollection, but

research into the processes that are involved in the certification and authentication of recollection as legitimate memory is very new. So our perception that the full story about remembering involves a dual ontology is not only a matter of interest to philosophers, but of course bears directly on the kind of psychological investigation which one includes in one's paradigm.

Cartesianism. Going further into this story leads us back to a watershed in the history of psychology which we can date roughly to the beginning of the 17th century. Until that time the idea of a person as composed of two substances, a corporeal and a mental substance, though it had been touched on from time to time, was not the animating ontology of the psychological sciences. The writings of medieval psychologists took it for granted that the intimacy of the mind–body relation precluded the idea of a duality of substance. Two things seemed to have happened at the beginning of the 17th century. The social dimension of psychological functioning was systematically forgotten and remained in discard for about 400 years. The individual side of the dual ontology of self developed another duality. On the one hand there are mental events and on the other there are physiological events and processes. The task of the psychologist was traditionally defined in terms of a kind of Millian investigation of the correlations and lawful concomitances of such events. Philosophical reflection very quickly produced the mind–body problem. Similar events occurring in radically different substances were thought to be somehow either causally or harmoniously interrelated in such a way that goings on in the mind had corporeal consequences and vice versa.

All of this dominated the ontological scene for centuries. It began to be displaced only in the 1930s by the reflections first of all of L. S. Vygotsky (1896–1934). Vygotsky was struck by the fact that much of the mental activity of small children occurred in public and was mediated by speech. He did not believe that there was a hidden mental world of psychological activity which was encoded into words and then publicly displayed. He became convinced that all mental psychology must be conceived by the exact reversal of the model. Mental activity is primarily public, consisting in the displays of verbal and manipulative skills. It is late in the development of a child that these become tucked away behind a barrier to the eye and ear of other people. Now this difference between Vygotskian and Cartesian metaphysics comes out very sharply when we think about how people can converse with one another. We might reflect upon what each viewpoint presupposes as the basic process of education. In the Cartesian view the dual individualist ontology would have two conversants in physical interaction by vibrations in the air, say, but not in mental interaction. Individuals, as joint sums of a mental and a physical substance, in so far as the physical substance is concerned, are part of one and the same world. The causal relation that links their bodies is common, but their mental worlds are radically disjoint. So in the Cartesian picture of a conversation there are three processes involved, the mind of a, the joint bodily universe of $a + b$ and the mind of b.

It is only too easy to see how the spurious mind–body problem with the illusion of the total separateness of the psychological states and processes of the other could come to be. The Vygotskian picture is based on the idea of appropriation. Vygotsky thought that the world of interpersonal interaction was shot through with symbolic content, so that the interactions of people, if taken as ontologically fundamental, presupposed a universe of symbols. This included, and we can take it as the model, conversational interactions, so that the developing human being played a part in an almost wholly public world. Individuality is a secondary formation and comes about by the appropriation by individuals from the common stock of interaction for useful processes, which can be clipped, private, and performed *sotto voce*, so to speak. So, the mind of an individual is part of the public conversation that has been partially fenced off. The contribution of Vygotsky through the ontology of psychology is twofold. First of all it proposes a thoroughgoing revision of Cartesian dualism to eliminate the bogus chasm between the physical and the mental. Second, it provides the foundations for the larger duality upon which

a psychology which recognizes both physiological and conversational processes must be based.

Neo-Cartesianism. Vygotsky was writing and researching in the 1930s. Many of his ideas were re-created again in the 1940s and 1950s by Gilbert Ryle (1900–76) and Ludwig Wittgenstein, who each in their own way contributed towards an anti-Cartesianism of much the same character as Vygotsky's conversational ontology. But it is one of the curiosities of contemporary thought that the consequences of the profound analysis proposed by Ryle and Wittgenstein were not effectual in reforming the science of psychology. To a very considerable extent psychology is still highly influenced by a neo-Cartesian point of view. I will return in a later section to develop the contributions of Ryle and Wittgenstein, which I see as complementary to Vygotsky, in more detail, but for the moment I want to turn to the revival of Cartesian ideas in some contemporary psychology. There are two strands of thought involved, one of which leads to the recent idea of a cognitive science out of which has come a somewhat disappointing, but enthusiastically promoted series of research programmes. The other has been the development of a philosophical thesis, currently dubbed 'eliminative materialism' which depends upon a strangely distorted conception of the conversational realization of psychological matters in what has been called 'folk psychology'. These two viewpoints are apparently at loggerheads over what there is, but nevertheless depend on taking the ordinary language, English, and many of its psychological terms dead seriously. So, for example, both viewpoints take it for granted that there are such entities as beliefs, pains, etc; the only question is what their status is.

Cognitive scientists have developed an ontology which takes a variety of different forms, but perhaps the most instructive for our purposes is modularity theory. Every human psychological function or activity is seen as the output of a processing module, a device which transforms information. So, for instance, to the human activity of remembering corresponds a memory module. A mind is the totality of such modules and, in the version of this theory influenced by computer science, the modules are thought of as constituting a system with links between them through which information is passed. The modules are not physiological entities, though I suppose most cognitive scientists would take a generally materialist view, and in the end the capacities for processing are to be found in the structure of certain physiological components of the brain and central nervous system. But by and large the metaphor – and it is widely employed – of computation involves the idea of something very like software and hardware, programmes and processors. At the back of this idea is the important step which moves from a verbal expression like 'I remember' to an alleged mental entity such as a memory module. The folk psychology expressed in the English language, so it is believed, legitimizes such a move.

Admiration for folk psychology is not confined to the cognitive scientists. Eliminative materialism is the latest version of an attempt to drive out mentalistic concepts altogether, but it is a good deal more subtle than the crude reductionisms of the past. Folk psychology is promoted as a kind of theory which, it is claimed, ordinary folk use to understand their own and others' behaviour. It involves such alleged entities as beliefs, feelings, intentions, and so on. These entities are arrived at by exactly the same processes of reification as we have noticed to be central to cognitive science. The performative utterance 'I intend so and so', or 'I will so and so', or 'I am going to so and so', is taken, without argument, as the display of the existence of an underlying entity, an intention. In just the same way 'I believe' is taken as the display of the underlying entity, a belief. The eliminative materialist then claims that neuroscience will gradually replace folk psychology as an explanatory theory of human behaviour and in the course of so doing the terminology which is typical of the psychological parts of English will come to change its meaning. Or perhaps it may even be dismissed from our conversation in favour of directly neurophysiological terminology. To take a comic example that is seriously promoted by John Searle, in the end

one may cease to talk about one's pains and talk instead of neuronal firings in the c-fibres.

I am inclined to think that cognitive science and eliminative materialism are based upon the same ontological move, that is, they depend upon the reification of speech categories, either as the material, so to say, basis of the cognitive system or as the 'material' in another sense of the subtle reductive argument of the eliminative materialists. The ontological claim would have to be sustained by a convincing argument that to my mind has not yet been produced that justifies the claim that performative operators like, 'I believe', 'I trust', 'I think', 'I suppose', are the outward and visible signs of these relevant cognitive entities. How to argue the matter out? Well, much will depend upon the role that one believes such operators play in the conversation. If we can give a complete account or at least a plausibly complete account of the rules of use of such expressions by reference to the necessities of a developing conversation, then we will hardly need, or it will seem otiose, to introduce alleged entities as the referents of such expressions. Furthermore, anthropological linguistics must be consulted upon this matter. If, as Rodney Needham has claimed, there are cultures which do not use the performative operator, 'I believe', and have no use for the concept of belief, then this lack of cultural universality must be explained. Is it that one large piece of the cognitive machinery of Europeans is missing in the heads of people who live in certain parts of Africa? This is clearly a highly implausible proposal. On the other hand, if, as Needham plausibly demonstrates, the cultural demands of East African society call for interpersonal relations of trust and their certification in language, rather than individual claims for knowledge and their certification in performatives of belief, then we have a social cultural explanation of the difference between these languages which does not involve the reification of any pseudo-objects. One might carry this type of investigation a very long way. For example, in work that P. Mulhausler and I have been doing on pronominal systems, it is apparent that there is no such conception amongst the Japanese as purely individual responsibility. The pronouns or their equivalents in Japanese are not indexical of individual speakers or actors, even though they are used to pick out the speech of a particular person.

But there is another very important and rather deep error in the ideas of the cognitivists that they have carried over from the older to the newer Cartesianism, an unexamined individualist assumption. There can be no doubt that physiologically we are pretty much individuals; though we have to breathe the tobacco smoke of others, nevertheless our brains are pretty disjoint and the physiological processes that occur in them are very individualized. However, we are not and could not be conversational individuals. As Wittgenstein has argued, highly convincingly, every language presupposes the possibility that the meanings of the expressions that occur in it could be learnt by anyone. So whatever grounds we have, talking the way we do must in the end have a public component, be it in behaviour, or in what other people have said. In general, conversations are joint actions. I will develop this theme in more detail when I look at the details of conversations and their ontological basis. Now, in so far as individualism is false as an ontological thesis concerning conversation and in so far as conversation is the essential second component of the dual ontology required for adequate psychological investigations of such processes as remembering, the neo-Cartesianist position must be rejected and with it the associated research programmes.

A Conversational Ontology. If we take seriously the idea that much that passes for psychology, for instance, remembering, reasoning, declarations of emotions, and so on, is intimately embedded in conversational processes, then the complementary ontology of psychology, complementary to a physiology of individual states, must be found in the metaphysics of conversation. We have already rejected the Cartesian picture of conversation as the causally mediated exchange between two disjoint minds. Instead we will adopt the Vygotskian view that conversation is a public and social entity and individual minds partially fenced-off parts of it. Persons, speakers on this view, become

places at which conversational events occur. So the 'I' which prefaces an 'I believe' and the 'you' which prefaces 'you must eat up your cabbage', are not so much expressions referring to psychologically complex entities, but simple indexicals identifying the person playing the role of speaker or listener. So, instead of a Newtonian world of space and time locations with material objects present at some of them, we are to envisage a conversational world of people-locations, a kind of people-space, and a public time constituted by the flux and flow of speech acts. In this picture the entities of conversation are the significant utterances themselves.

What binds these utterances into a world of conversation? Well, it can't be anything subjective, according to this point of view. Whatever binds a conversation together must itself be conversational in character, i.e. public and social. John Austin (1911–60), long ago, pointed out that a speech act is only completed in the illocutionary uptake by he or she who receives it. If you don't take my proposal as an offer, then conversationally speaking no offer has been made, no matter what I intended. From a conversational point of view, then, the conversational world is created by displays of intention and manifestations of uptake, because these are the public and social aspects of the completion of a speech act as intended and understood.

Now, one might object, surely there is a subjective intending and an individual and subjective understanding. Well, is there? Of course, it is individual persons who intend and understand, but how do these capacities come to be amongst their skills? Well, one picture would have it that persons have a complex inner structure and intentions and understandings are states, processes in that inner structure. But then their inner structure itself is subject to just the same kind of ontological analysis as the conversation. What is the self to which 'I' refers, once again within the partially closed-off conversation? But the 'I' is once again no more than the conversational indexical that labels particular subjective conversational acts as belonging to the speaker, the person. So even within the subjective arena we have learned to separate off from the public conversational world, there is nothing but indexicality, there is nothing but speakers.

This idea has profound consequences. The first and most important of these can be seen by reflecting on the fact that speech acts have direction: I confess to you, the judge condemns the prisoner and not the prisoner the judge, I make you an offer, you refuse it, and so on. So offers, refusals, condemnations, proposals, insults, and apologies are directed. In the conversational world they are extended objects, because, as I have pointed out, a speech act is not completed until it has been accepted, understood, etc. by the target. This means that speech acts, according to this model, are extended objects aligned in certain directions in people-space. Now what determines these directions? The most important determinant is that of the rights, obligations, and duties the members have as speakers according to each one's social role. So only certain people in a role are licensed to condemn, to judge, to give absolution, to make certain requests, and so on. These role-related rights and duties constitute what one might call the moral order for the conversation. Different societies have different types of conversation moral orders and different systems of performative utterances with different kinds of force.

A very simple, but striking, example of how a conversation convention can readily be confused with a Cartesian inner property is the phenomenon of rationality. Historical studies show that the claim that women were irrational and had special psychological attributes such as intuition, is simply a reification and subjective individuation of a conversational convention. During the course of the Industrial Revolution the convention sprang up amongst the bourgeoisie that as part of their display of decorative lack of utility women should speak in a distrait, charming, and disorderly fashion, leaving the hard work of rational discourse to men. So the normal conversational convention of accountability, which makes it proper for men and women to demand of each other the reasons for what they said, was suspended in the conversations between men and women, among people of that social class. Similarly the alleged rationality of scientists has been shown by invest-

igators such as B. Latour and S. Woolgar to be a reification of a conversational 'convention' governing the way scientific discourse is put together in written scientific work, or in a lecture given to a scientific meeting.

Psychology then, on this view, must make good its dependence on this ontological basis, so that an enormously important dimension of psychological research can now be identified. It is the study of the organization of speech acts in conversations in the course of which the psychological aspects of human life are largely constituted. There are certain other consequences too, because by adopting this point of view features of our psychological lives that are hidden from us if we look at the world with only the Cartesian concepts in mind become visible. In particular there is the important phenomenon of psychological symbiosis. If such matters as rationality, remembering, emotions, and so on are constituted by the interaction between conversation and physiological events, and conversation is something that in general and in principle involves a multitude of people, the possibility exists for one group of people or one person to perform the conversational acts that are attributed psychologically to another. In psychological symbiosis one person routinely complements or subtracts from the psychological competence of another by inserting utterances into the conversation, which either strengthen the impression of competence that the other person displays or takes away from it. Developmental psycholinguists have long been aware that a necessary condition for the development of linguistic skills in an infant is the conversational symbiotic relationship in which it stands primarily to its mother from the day of its birth. E. Goffman and others have identified symbiotic processes in the conversations of adults. Now, this has a profound effect on our willingness to accede to a generally individualist psychology. If many of our psychological attributes are not ascribed to us on the basis of our individual performances, but on how our performances are supplemented or depleted by the activities of friendly or hostile others, then there is no such thing as the psychology of an individual person.

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ROM HARRÉ

Putnam, Hilary

Hilary Putnam was born in 1926 in Chicago, Illinois. He studied at the University of Pennsylvania and at the University of California, Los Angeles, where he worked under Hans Reichenbach. During the 1950s Putnam worked closely with Rudolf Carnap, who strongly influenced his thinking.

Putnam has made important contributions to virtually every major area of philosophy, but he is best known for his work in philosophy of mind, philosophy of language, and metaphysics.

His early work supported a science-based version of metaphysical realism but more recently he has criticized such views, and now rejects all forms of metaphysical realism. He has adopted instead a position that he calls 'internal realism' or 'pragmatic realism', which he sees as a middle road between metaphysical realism and cultural relativism. According to pragmatic realism we cannot ask what exists apart from a conceptual scheme. Within a conceptual scheme, however, we can say quite straightforwardly what really exists. Pragmatic realism is considered by Putnam to be a moderate form of realism but is closely allied with and influenced by the work of contemporary anti-realists such as Michael Dummett and Nelson Goodman.

In the philosophy of mind Putnam proposed a programme that came to be known as 'functionalism'. Functionalism is an alterna-

tive both to central state materialism, according to which thoughts, feelings, and attitudes are identical with brain states, and to behaviourism. The functionalist hypothesis is that thoughts and feelings are not specific physical states of a human being but are functional states. A functional state would be characterized in terms of its functional role rather than its physical constitution. For example, a mental state could be described as a function from a state of the person plus stimulation to behaviour. A given functional state could be physically realized in a limitless number of different ways, not just in the way that the human brain realizes it. Entities of many diverse physiologies could have the same functional organization. At first Putnam argued that the functional organization of human beings is that of a Turing machine, a very basic sort of idealized computer, but he has now given up that view as overly simplistic.

In the philosophy of language, Putnam was instrumental, along with Saul Kripke and others, in arguing that the meaning of a natural-kind term such as 'water', 'gold', or 'tiger' cannot be given in a definition that states a non-trivial necessary and sufficient condition for falling under the term. This is not just because the terms are vague or family resemblance terms. Putnam argued that we introduce a term such as 'water' by 'baptizing' a paradigm – an instance that we take to be a good example of the kind. We thereafter mean to refer with the term to whatever is of the same kind as the paradigm. Thus according to Putnam the essence of a natural kind would not be a concept that could be expressed in a linguistic definition. Essences of natural kinds are not to be discovered by linguistic analysis, rather they are the objects of empirical scientific study. We learn what the essence of water is when we learn about the chemical make-up of that stuff we refer to as water. We have learned, in fact, that water is H_2O. This is not a matter of linguistic definition, nor does it become a definition of 'water', since it is always revisable on the basis of further research.

Putnam claims that most natural-kind terms are subject to what he calls 'the division of linguistic labor'. Although speakers of English are able to use such terms as 'gold', 'diamond', and 'elm', they need not be able to distinguish, say, gold from other yellow metals or elms from beeches – for that, we have experts on whom we rely. I may not be able to distinguish elms from beeches and my mental concept of elm may be the same as my mental concept of beech, yet it still is not the case that when I use the term 'elm' I mean the same thing as when I use the term 'beech'. According to Putnam, there are strong social, historical, and scientific dimensions to linguistic meaning. Meanings are not concepts in the heads of individual speakers of the language.

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STEPHEN P. SCHWARTZ

Pythagoras, Pythagoreanism

Pythagoras has inspired or attracted ideas of such great range and vitality that it is a difficult task to sort out how these ideas accumulated around his name. He spent his earlier years on Samos, an island near Miletus, birthplace of pre-Socratic cosmology. Around 532 BC he moved to Croton in southern Italy where he founded a religious sect that acquired political power in the Greek cities of the area. He taught survival and transmigration of the soul to other bodies. Care of the soul involved such practices as vegetarianism and ritual purification. His fame as polymath and enquirer, derided by Heraclitus in the early 5th century, suggests he shared the philosophical interests of his contemporaries in Ionia. However, in the absence of Pythagorean texts of the 6th century and first half of the 5th century BC, it is difficult to be sure that these interests

included the mathematical cosmology that Aristotle attributes to 'Pythagoreans' and that is found in the fragments of Philolaus, a Pythagorean of the late 5th century BC. Philolaus saw the universe as made up of two kinds of things, the 'unlimited' and 'the limiting'. 'Harmony' is necessary for the combination of these, and this harmony seems to be constituted of numerically expressible ratios (hence the 'music' of the heavens). Philolaus also claimed that all that is known has number, for without number nothing can be known, and that the first thing constituted was 'the one'. Aristotle believes (*Met.* I, 5) that the Pythagoreans, confusing arithmetical, geometrical, and physical units, both made things out of numbers and saw things as expressible in numerical ratios. The number 10 is perfect as containing all numbers, being made up of the first four integers which also express the basic musical intervals. We cannot now determine how much of all this goes back to Pythagoras and his immediate followers.

When Plato visited southern Italy and Sicily in 387 BC, his contacts with Pythagoreans there (in particular Archytas) had a profound effect. He refers to wise men for whom the cosmos is ordered in friendship and to 'geometric equality' (= proportion?) as of great importance for gods and men (*Gorgias* 508a). He writes of a Prometheus who conveyed to man the divine doctrine that things that always are, are from 'one' and the 'many', being made of limit and the unlimited (*Philebus* 16cd). This doctrine implies a method for discerning all forms intervening between the one and the unlimited, a method which Plato himself applies. Such ideas suggest that the philosopher may use a method inspired by mathematics (cf. *Meno* 86e–87b). However, as Plato expresses it in the *Republic*, mathematics, though indispensable, is subordinate to the highest philosophical knowledge ('dialectic'), for dialectic grounds the hypotheses of mathematics and is concerned with the very source of being and knowledge, 'the Good'. Dialectic is to guide rulers of the ideal state who remind us of the Pythagorean figure Timaeus who shows, in Plato's *Timaeus*, how mathematical structures constitute souls and the elements of the world.

Aristotle's reports on Plato suggest an even more extensive mathematizing approach. All reality, Aristotle says (*Met.* I, 6), derives for Plato from two principles, the 'one' (= the Good) and the 'indefinite dyad'. From these come Plato's Forms, which Aristotle identifies as ideal or transcendent numbers, whence derives the physical world. Much of Aristotle's reports remains obscure. Plato's immediate successors in the Academy, Speusippus (*c.* 407–339 BC) and Xenocrates, (*c.* 395–314 BC) elaborated on the theories reported by Aristotle, which they regarded as 'Pythagorean'. However, Aristotle rejected this Pythagorizing Platonism, distinguishing it from pre-Platonic Pythagoreanism.

The confusion between the metaphysics of Plato's Academy and ancient Pythagoreanism was complete in the first centuries BC and AD, when a number of writings were composed and attributed to Pythagoras and ancient Pythagoreans, sometimes plagiarizing Plato and Aristotle and even showing traces of Stoicism. Philosophers in the first centuries AD such as Numenius (*c.* 150–200) and Nicomachus claimed that Plato merely followed Pythagoras, a claim elaborated by the Neoplatonist Iamblichus. For him Pythagoras was the source of Platonism (and of what is true in Aristotle), Pythagoras himself sharing in the ancient divine wisdom of the Chaldeans and Egyptians. Iamblichus developed the identifications made by Nicomachus and others between the first ten numbers and aspects of the world, of man and of the gods ('numerology') in a Neoplatonic framework. Physics, ethics, and politics he saw as being modelled on mathematics, just as mathematics foreshadows the science of the divine. Numbers correspondingly function as paradigms of the physical world and as images of the gods. As evidence of the divine origin of this doctrine, Iamblichus collected in his *Vita Pythagorica* the legends associated with Pythagoras. Later Neoplatonists did not 'Pythagorize' quite so much. But mathematics remained for them (and geometry in particular for Proclus) the model of scientific method, the key to the universe and to the divine.

Pythagorizing Neoplatonism was transmitted to the Latin Middle Ages in particular

by Augustine and Boethius. It was hardly a dominant trend. However, some thinkers, notably those associated with Chartres in the 12th century, went beyond numerology in discussing the cosmological and theological applications of numbers. Nicholas of Cusa, who read Proclus, inaugurated the return of Pythagorizing Neoplatonism in the Renaissance in his studies of mathematics in relation to the world and God. In the second half of the 15th century, Marsilio Ficino popularized this sort of Pythagoreanism as part of an ancient theory more compatible, he thought, with Christianity than with Aristotelianism. Thus such ideas as the music of the heavenly spheres, the harmony of the universe, the mathematical structure of the universe as imaging the divine mind, became commonplace and turn up, for example, in Nicholas Copernicus (1473–1543) and in Johannes Kepler (1571–1630), who quotes, in his *Harmonice mundi* (1619), from Proclus's *Commentary on Euclid*. This text, which had attracted the interest of Renaissance mathematicians, presents mathematics as an exemplary scientific method that can be transposed to other domains, in particular physics and metaphysics. This is not far from the projects of a universal scientific method explored by René Descartes and by Leibniz.

If today numerology has been driven from mathematics into the realm of popular superstition, if philosophers who hear the heavenly harmony or discern the divine mind in the geometry of the world are few, if mathematics provides physics with a language rather than with its basic truths, if metaphysics looks more to words than to numbers for its insights, still aspects of (Platonist or Neoplatonist) Pythagoreanism remain, such as the idea that mathematical objects exist, the belief in the purity and even beauty of the knowledge of such objects, and the aspiration to measure, proportion, and harmony as ethical ideals.

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DOMINIC J. O'MEARA

Q

Qua

A '*qua*' connective, like other conjunctions, such as 'if' and 'since', links up sentences, clauses, and phrases in other sentences. (I use '*qua*' to stand for the generic connective, of which also 'in so far as', 'in virtue of', 'with respect to' are instances.) '*Qua*', and equivalent expressions, occur at important points in the work of many philosophers: in Aristotle's doctrine of being *qua* being (*Met.* IV); in the supposition of subject terms in sentences like 'man is the worthiest of creatures' according to William of Sherwood (*Introductiones ad logicam*, 77, 18–28); in the analysis of the Incarnation by Aquinas (*Sentences* III.XI.1; *Sum. Theol.* III.16.8–10), and Scotus (*Sentences* III.XI.2). It occurs also in Leibniz's formulation of the identity principles and in his reduction of relationships; in one of Bertrand Russell's solutions to Russell's Paradox (*Principles of Mathematics* I.X.104); and in Martin Heideggers's discussion of '*als*' in *Sein und Zeit*. The reasons for this repeated occurrence are fairly obvious: whenever senses of concepts are to be distinguished, whenever different aspects and

modes of a thing are to be singled out and abstracted, whenever an assertion is to be qualified in a certain respect, the appearance of *qua* expressions is nearly inevitable.

There have accordingly arisen analyses of the logical properties of *qua* propositions. According to the standard Aristotelian analysis, worked out in its full form by the end of the 12th century, there are two main logical types of *qua* propositions, the reduplicative and the specificative. A standard example of the reduplicative is: 'every man *qua* rational is risible'; for the specificative, 'the Ethiopian is white with respect to his teeth' (Aristotle, *Soph. El.*, 167a7). For the reduplicative, the inference, '*S* is *P qua M*; therefore *S* is *P*' is valid; for the specificative it is invalid. In a specificative *qua* proposition, the *qua* phrase changes the reference of the unqualified subject; in a reduplicative one, it does not.

An exhaustive analysis of reduplicative propositions was given by such philosophers as William Ockham and Walter Burley (*De puritate artis logicae tractatus longior*). The basic analysis for '*S* is *P qua M*' is '*S* is *M*, and every *M* is *P*'; most medieval analyses also add: 'and being *M* entails being *P*'. Further conditions were also added for special types of reduplicative propositions; e.g., '*M* is the cause of *P*' for the causal reduplicative. Thus, to take the standard medieval example, 'man in so far as rational as risible' is to be analysed as: 'man is rational, and man is risible, and every rational thing is risible, and if something is rational, it is risible'. On the causal analysis, a fifth exponent, 'being rational is the cause of being risible' is added (William Ockham, *Summa logicae* II.16). As was recognized explicitly by those such as John Wyclif (*c.* 1320–84), however, some of the conjuncts of these expositions are redundant; thus the basic reduplicative analysis may be reduced to: '*S* is *M*, and being *M* entails being *P*' (*Tractatus de logica*, I.5).

Specificative propositions were not analysed further, except that explanations were offered in such a way as to make their meaning plainer. Here the formal work centred more on how the *qua* phrase changes the reference of the unqualified subject into something related to it. This discussion was generally put in terms of parts and wholes; e.g., by Albert the Great (*De Sophisticos Elenchos* I.III.6). Thus, as teeth are an integral or material part of a whole human body, 'in respect of his teeth' when attached to 'the Ethiopian', changes the reference from the whole, the human body, to the integral part, the teeth.

Aristotle himself, though not giving an explicit systematic theory of *qua* expressions, does discuss formal properties of propositions containing *qua* expressions (in *De Int.* 21a7, *Post. An.* 73b26, and in *Top.* 115b15). Later Aristotelians codified Aristotle's remarks, and developed various theories from them. Propositions containing *qua* expressions were called 'reduplicative', because Aristotle uses the term 'reduplication' (ἀναδίπλοσις) in discussing them, as his examples of *qua* propositions generally had a repetition, or reduplication, of one of the terms. Thus consider his syllogism: "the good is known, that (ὅτι) it is good; justice is good; therefore justice is known, that it is good" (*Pr. An.* 49a11). In the medieval period, many important philosophers devoted much attention to formal properties of reduplicative propositions; Avicenna (*Al-Qīyās*, 485, 1), Albert the Great, and William Ockham, in particular. Likewise, there was much discussion of reduplicative propositions in the post-medieval period, though not as much originality. In the modern period, with the decline of interest in formal logic, reduplicative propositions fell into obscurity. Still, in the 20th century, with the renewal of interest in logic, interest in *qua* propositions has revived.

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ALLAN T. BÄCK

Quantum Physics

All revolutionary results in physics result in a necessity of our rethinking our intuitive ontological/metaphysical categories in order to revise our picture of the world so as to, in one way or another, make our metaphysical picture and our scientific theories compatible with one another. No scientific result has been as intractible to metaphysical comprehension, however, as has been the quantum mechanical picture of the world. While the special and general theories of relativity have forced us to revise our traditional metaphysics of space and time, quantum mechanics seems to be calling out for a radical revision in our very notions of what is to constitute the 'objective' states of the world. So puzzling are the features of the world it describes, and so radical is the theory developed to account for these features, that even now, half a century after the discovery of quantum mechanics, no satisfactory metaphysical accounts of the world exist which will do justice to all the perplexing features of the quantum mechanical picture of the world.

From the very beginning the basic experimental facts on which the theory rested seemed to force us to consider the basic structure of the world to be, at one and the same time, that of a continuous wave yet that of discrete, spatially localized, particles. Werner Heisenberg's (1901–76) famous "Uncertainty Relations" pointed out the direction in which blatant inconsistency could be avoided in this world picture, but only at the cost of, at least, placing severe restrictions of principle on our epistemic access to the world. From this arose the earliest claims that the quantum picture of the world was incompatible with determinism or even with the claim that each event could be causally explained by reference to a sufficient antecedent state of the world.

Max Born's (1882–1970) understanding of the wave-function as generating probabilities of outcomes of measurements carried the understanding of the theory further, but interference effects showed that a naïve 'ensemble' model of these probabilities could not succeed. Niels Bohr's (1885–1962) extraordinary 'Copenhagen Interpretation' of the theory provided the first systematic 'metaphysics' for quantum mechanics with its notion of a quantum description as instrumentalistic and relative to a chosen measurement process, and its evasion of inconsistency by the notion of features of the world being 'complementary' so that only one framework of description was applicable relative to any one possible set of measurements. But the special role played by 'measurement' as a process not describable within the physical theory, a role represented in the formal theory by the so-called 'projection postulate' of John von Neumann (1903–57), left one dissatisfied with the account and perplexed by its retention of classical concepts for the results of measurement while at the same time proposing their illegitimacy from the quantum point of view.

Over the years the early suspicion that the theory led to a radically indeterministic picture of the world has been buttressed by a series of demonstrations that no positing of 'hidden variables' is compatible with the statistical correlations posited by the theory. An early proof of von Neumann's which rested on posits stronger than those justified by quantum mechanics has been replaced by newer developments at the hands of A. Gleason, S. Kochen and E. Specker, and J. Bell. The Bell result suggests also a radical 'non-locality' of the world described by quantum mechanics. Systems once spatially united but now separated so as to be unable to causally influence one another show correlations in outcomes of measurements performed upon them which are, by an extraordinarily simple argument, incompatible with their being explained by a causal route which traces back to their initial local correlation in a classical way.

The 'measurement problem' remains the most distressingly perplexing puzzle about quantum mechanics. The theory seems to

describe the world entirely in terms of quantum mechanical states of a radically non-classical nature. Yet its interpretation refers to 'measurements' whose dynamics falls outside the dynamical evolution posited for all physical interactions by the theory, and which results in final states characterized in a purely classical way. Formally superposition states fail to evolve in a 'unitary' way upon measurement. Instead 'interference terms' disappear and the wave-packet 'collapses' into one of its components in the decomposition of it into components appropriate to the measurement performed. How is this to be understood?

Many approaches try to solve the puzzle by denying that projection really takes place. The quantum state function is understood 'realistically' to characterize the objective state of the world. All measurement interactions are taken to preserve superposition, the appearance of projection being due to the macroscopic size of the measuring instrument which allows one to take the interference terms to be zero without much predictive error. But these accounts fail to explain why only one component (instead of the set of all of them) appropriately describes the world. The 'many worlds' interpretations, initiated by H. Everett, try to solve that problem by arguing that the world 'splits' into many different worlds at each interaction, one world for each possible component. Here the major problem seems to be to explain our experience which is of one world and one component only.

Other interpretations are 'instrumentalistic' with regard to the quantum state. In some it is classical states of physical measuring apparatus which are taken as reality. In others it is the subjective states of the minds of 'observers' which are real. The former version suffers from treating large physical objects as 'outside' the physical realm which ought to be universally describable by quantum theory. The latter is, clearly, far too 'idealistic' an account of the world for many, especially given the propensity to seek for a materialist account of mind. These instrumentalistic accounts are all the successors of Bohr's 'Copenhagen Interpretation', and all utilize in one way or another variants of his subtle methods for avoiding inconsistency in the interpretation. Many still share Albert Einstein's (1879–1955) view that this way of viewing the theory achieved irrefutability at the price of obscurity and evasion.

In the 1930s G. D. Birkhoff (1884–1944) and von Neumann showed that there was an interesting formal sense in which the propositions of quantum mechanics formed a 'logic' weaker than traditional Boolean propositional logic. In particular, distributivity was violated in this schema. Hans Reichenbach had once proposed that the puzzles of quantum mechanics could be avoided by using a many-valued logic. More recently D. Finkelstein, Hilary Putnam, and others have attempted to show that one could maintain a 'realistic' metaphysics for quantum mechanics if one understood the Birkhoff-von Neumann 'logic' as really being the logic of the world, that is if one took quantum mechanics as showing that we needed to modify logic as general relativity showed us we needed to modify our geometry of the world. The ability of this move to solve the puzzles is controversial, as is, of course, the coherence of the claim that logic is 'empirical'. Related suggestions try to save a realist account of the world in the quantum mechanical picture by rejecting orthodox probability theory in favour of a modified theory. One such version avoids the apparent demonstration of indeterminacy and non-locality of the Bell results by allowing conditional probabilities to exist where absolute probabilities do not.

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LAWRENCE SKLAR

Questions

This topic has been discussed since Aristotle. Here we describe three approaches of current import.

The *autonomous systems approach* is represented by a system of Nuel Belnap. Belnap assumes a standard formalized language and adds special symbols to form interrogatives. An *elementary* interrogative has a form that indicates a *subject* and a *request*. Thus for *whether* interrogatives, the subject is a list of distinct statements; these are the *alternatives* presented by the subject. For *which* interrogatives, the subject indicates a formula F that has free variables, and perhaps also indicates some category conditions corresponding to some of those variables; this subject presents as alternatives all the statements that come from F by substituting closed terms t for the free variables in F, where each t must satisfy the category condition, if any, that has been specified. For all elementary interrogatives, the request component has a form that indicates:

1. lower and upper bounds on *selection size*,
2. presence or absence of a *completeness claim*, and
3. presence or absence of a *distinctness claim*.

For any elementary interrogative, each *direct answer* is a statement that:

1. Selects a number n of the alternatives presented, where n is within the bounds on the selection size;
2. claims that these are all of the true alternatives if the relevant request indicates that a completeness claim is to be made; and
3. claims that these are distinct alternatives if the request calls for a distinctness claim.

X is a *complete, partial, eliminative*, or *quasi eliminative answer* to a given interrogative I just in case X implies some direct answer to I, is implied by some direct answer to I, implies the negation of some direct answer to I, or is implied by the negation of some direct answer to I, respectively. If the semantics is such that every individual has a name, then I is *true* just in case some direct answer to I is true. Where not all individuals have names, each formula F with free variables presents not only *nominal alternatives* (which are like the alternatives described above) but also *real alternatives* (which are pairs consisting of F plus a function that assigns denotations to the variables that are free in F). Then a which-interrogative can fail to have true nominal direct answers and fail to be nominally true, but still have true *real direct answers* and be *really true*. An interrogative I presupposes X just in case X is true whenever I is true. If an interrogative has any presuppositions, a unique one can be chosen as *the* presupposition.

The *imperative-epistemic approach* is that of Lennart Åqvist and Jaakko Hintikka. They assume a language with imperative and epistemic operators (including 'Make it the case that' and 'I know that'). Then, e.g., they can use 'Make it the case that either I know that P or I know that Q' to ask whether P or Q, and can use 'Make it the case that, for some x, I know that Fx' to ask for one example of a thing with the property F.

In the approaches described above we construct a system of interrogatives and then either equate questions with the interrogatives or stipulate that questions are denoted or expressed by the interrogatives. The *Platonist approach* finds that questions exist as independent entities, whether interrogatives exist to express them or not. In Pavel Tichy's system a *question* is a function on possible worlds. Common types of questions are propositions, individual concepts, and properties; their values for a given world are a truth-value, an individual, and a set of individuals. To *answer* a question is to cite an

entity of the right type; the answer is *right* if the entity is the value of the function at the actual world. A *complete* answer cites a single entity; an *incomplete* one cites a class and is *correct* if the right complete answer is in the class.

Consider, for example, the question 'Does God exist?' In Belnap's system there is an interrogative that presents as alternatives the two statements 'God exists' and 'God does not exist', and requests that the respondent assert 'God exists' or 'God does not exist', those two statements being the two direct answers. In the imperative-epistemic ap-proach one issues the command: 'Make it the case that either I know that God exists or I know that God does not exist'. In some versions of this approach the respondent may satisfy the command by some means other than simply asserting 'God exists' or its negation. In Tichy's approach there exists a proposition that God exists. The given question can be expressed by saying that God exists, and it can be answered completely by saying 'true' or 'false'.

There is a relation between questions that holds when every direct answer to the first question implies some direct answer to the second. Some theorists regard this as a relation of *implication*, some call it *containment*, and some call it *obviation*.

Most theorists agree on the meaning of *whether* and *which*. There is less agreement on *what*, *who*, *how*, and *why*. There is agreement that two interrogatives can be conjoined via *and*, and agreement that they can be disjoined via one type of *or* (meaning 'answer either question') or by another type of *or* (meaning 'Try to answer the first; if you can't, answer the second'). Most theorists allow conditionals 'If P, then I' (where P is a declarative and I an interrogative) and adopt the rule: given P, one may detach I.

There is disagreement on whether every I presupposes that some direct answer to I is true, or merely that some core assertion (which is implied by every direct answer to I) is true. Most theorists agree that, if the presupposition of an interrogative is false, then the given interrogative *commits the fallacy of many questions*. For a set S of sentences to *raise* a given interrogative it is necessary that S imply the presupposition of this interrogative. For S to *suppress* I it is sufficient that S imply the negation of I's presupposition. When in doubt about the truth of this presupposition, the safe way to ask I is to use the conditional 'If the presupposition holds, then I'.

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DAVID HARRAH

Quine, W. V. O.

Willard Van Orman Quine was born on 25 June 1908 in Akron, Ohio. He majored in mathematics at Oberlin College and wrote his Ph.D. dissertation at Harvard under A. N. Whitehead's supervision. Several of his philosophical views grew out of his critical examination of Rudolf Carnap's ideas. After Carnap and Bertrand Russell, Alfred Tarski is probably the author who had the strongest influence on Quine, even though Quine's originality makes the word 'influence' inappropriate.

Language-theory Conglomerate. It is commonly held that there is a difference between dictionaries and encyclopaedias. The former provide information about linguistic meaning. The latter supply factual information about the world. Quine mitigates this distinction. Sentences are associated with sentences in a "vast verbal structure which, primarily as a whole, is multifariously linked to nonverbal stimulation" (*Word and Object*, 1960). Thus, for instance, the sentence 'There is copper in this test tube' can be elicited by the observation of a green tint resulting from the mixing of the contents of two test tubes. Admittedly, in this example chemical theory which secures the connection can be dissociated from linguistic meaning. In most cases, however, there is no sharp distinction to be drawn. Common sense is nothing but a primitive theory. But common sense is built into our language. For instance the very existence

of common nouns denoting reidentifiable particulars is a linguistic feature which is connected with "the immemorial doctrine of ordinary enduring middle-sized physical objects" (ibid.). Hence the above-mentioned 'vast structure' is neither a language, nor a theory, but both: it is a conglomerate for which D. Føllesdal has coined the word 'language-theory'.

Pierre Duhem (1861–1916) claimed that statements of physical theory cannot be confirmed or disconfirmed in isolation. Quine goes further. Seeing that all branches of science share logic and some mathematics, he subscribes to a generalized form of epistemological holism:

> Holism at its most extreme holds that science faces the tribunal of experience not sentence by sentence but as a corporate body: the *whole* of science (see Hahn and Schilpp 1986).

Consequences of Epistemological Holism. When epistemological holism is combined with a verification theory of meaning it leads to semantic holism, as Føllesdal has emphasized. Isolated statements abstracted from the scientific theories to which they belong do not have a fund of experiential implications attached to them. From this it follows that "it is nonsense . . . to speak of a linguistic component and a factual component in the truth of any individual statement" (*From a Logical Point of View*, 1953). Hence the distinction between synthetic statements (true in virtue of the facts) and analytic statements (true by virtue of the linguistic conventions alone) collapses. It also follows that the reductionist programme of rationally reconstructing theoretical concepts of the natural sciences in terms of observation terms has to be abandoned. Quine replaces it by the study of how we actually learn the language of scientific theory:

> The scientist himself can make no sense of the language of scientific theory beyond what goes into his learning of it (*The Nature of Natural Knowledge*, 1975).

The paths by which we learn our language widely diverge:

> Different persons growing up in the same language are like different bushes trimmed and trained to take the shape of identical elephants. The anatomical details of twigs and branches will fulfil the elephantine form differently from bush to bush, but the overall outward results are alike (*Word and Object*).

The linguist who is engaged in radical translation, i.e. translation between culturally separated languages, is very much in the same position as the child learning his mother tongue:

> Manuals for translating one language into another can be set up in divergent ways, all compatible with the totality of speech descriptions, yet incompatible with one another (ibid.).

The thesis of the indeterminacy of translation – this is its name – is thus a corollary of semantic holism.

Mutual Containment of Epistemology and Ontology. Let us return to epistemological holism. If the totality of our knowledge is, as Quine says, "like a field of force whose boundary conditions are experience" (*From a Logical Point of View*), then there is no space left for an autonomous epistemology, i.e. for prior philosophy which would be an *a priori* propaedeutic or groundwork for science. Epistemology can no longer be conceived as offering an external foundation to science. With Quine, epistemology acquires the status of a natural science. Its role is to explain the knowledge ability of the human subject considered as a natural phenomenon. And to that extent it belongs to ontology, which aims at answering the question 'What is there?' Once epistemologists renounce the impossible task of providing foundations for science, they are entitled to do what was denied them previously, i.e. to appeal to science. Explaining induction by natural selection is no longer a *petitio principii*, since the epistemologist does not aim at justifying science. Even though it has become, in effect, a branch of psychology, epistemology can still contain natural science in so far as it does not take physical objects for granted, but studies how the conceptual framework which underlies thing-words such as 'trees' or 'rocks' is constructed by the human mind from observational data.

Two Perspectives on Ontology. To know what there is, one should simply enquire into what science assumes to be real entities. When unnecessary ontological commitments have been withdrawn, science remains with two kinds of entities: material objects and sets. If there is a one-to-one transformation between one set of entities and another – for instance, space-time points and quadruples of real numbers – we can freely switch between them. This freedom was dubbed "ontological relativity" by Quine. This relativity, however, concerns the epistemology of ontology rather than ontology itself.

Truth as Immanent to Theories. Just as manuals of translation can be set up in divergent ways, compatible with the totality of speech dispositions, so physical theories can vary though all possible observation be fixed. This is the thesis of the underdetermination of theories by observation, a corollary of epistemological holism. From the fact that conflicting physical theories can be on equal footing as far as the assertions they warrant are concerned, it does not follow that they are equally true. The predicate 'true' has meaning only *within* a theory. It is immanent to theories but within these confines it remains absolute.

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PAUL GOCHET

R

Ramsey, Frank Plumpton

Frank Plumpton Ramsey (1903–30), the son of the president of Magdalene College, Cambridge, was one of the most gifted persons of his time. He became a student of Bertrand Russell, G. E. Moore, and John Maynard Keynes (1883–1946) and already when he died at the age of 26 he left behind a large corpus of published and unpublished papers, which contributed substantially to such disparate fields as formal logic, foundations of mathematics, truth and probability theory, philosophy of science, epistemology, and last but not least economics.

Ramsey's lasting significance lies without doubt in his novel approach to the exact sciences, developed in his "Last papers". This approach rests on two assumptions: first, the "Principles of finitist mathematics" (this is the title of a late manuscript in the Ramsey Collection, Pittsburgh, where Ramsey discusses different forms of finitism, defending the view of Hermann Weyl (1885–1955) against those of L. E. J. Brouwer (1881–1966) and Thoralf Skolem (1887–1963)), giving the infinite only a theoretical, explanatory meaning; and second, on the construction of *theoretical functions* by which we explain the inductive generalizations in the empirical sciences. This approach, which has been widely received thanks to the work of Rudolf Carnap, J. D. Sneed and Wolfgang Stegmüller, is still not fully reflected in its finitistic origin and its pragmatic impact.

Ramsey is best known, however, for his *simplification* of Russell's theory of types, in which he dispensed with the dubious axiom of reducibility. Russell's solution of the antinomies had led him to postulate hierarchies of orders within the hierarchy of types. In order to cope with the unwanted hierarchies of orders, Russell had to postulate the axiom of reducibility. Ramsey, who first distinguished between logical and semantical antinomies, was able to avoid the latter by a new strategy using Ludwig Wittgenstein's notion of 'truth-functions in extension' with infinitely many arguments. This made the distinction of orders, and therefore the axiom of reducibility, superfluous.

Beside the axiom of reducibility, it was the *axiom of infinity* which formed the main obstacle in the reduction of mathematics to logic: for it was far from clear (indeed it was doubted by Russell himself) that the axiom of

infinity was a purely logical proposition. At the same time, however, it seemed impossible to build up analysis without the axiom of infinity. In "Mathematical logic" (1926) Ramsey considered three different ways out of this dilemma:

1. David Hilbert's proof theory, in which the axiom of infinity is taken as a mere *assumption* which can be proved (by finite means) to be *consistent*, and therefore should be permissible in mathematics.
2. The finitist approach, in which the axiom of infinity is abandoned completely, the aim being then to develop a kind of mathematics in which only *finite* and no "transcendental methods" would be permitted: "the methods to be adopted might resemble those of Brouwer and Weyl. These authorities, however, seem to me to be sceptical about the wrong things in rejecting not the Axiom of Infinity, but the clearly tautologous Law of Excluded Middle" (*Foundations*, p. 80).

Needless to say, these proposals were not in the spirit of the logicist programme. Therefore, Ramsey at first accepted:

3. The tautological interpretation of the axiom of infinity. This proposal was based on Wittgenstein's assumption that general and existential propositions are conjunctions and disjunctions, i.e. truth-functions of infinitely many propositions as arguments. On this view, the axiom of infinity becomes necessarily a tautology, because "if no infinite aggregate existed the notion of such an aggregate would be self-contradictory" (*Foundations*, p. 79).

Later, however, Ramsey abandoned this view as question-begging because it depends on the identification of general sentences with infinite conjunctions, and this identification may be doubted (see Church 1932). In other words, except in the finite case, the truth-value of a general proposition is not a function of its singular propositional instances. Instead, in "General propositions and causality", Ramsey defended another view, the position of Weyl, treating general sentences not as propositions in the truth-functional sense but as "variable hypotheticals", that is as *rules for judgements* (*Anweisungen auf Urteile*) which means that a potential infinite set of concrete judgements can be deduced from it.

Likewise, an existential sentence, $\exists x f(x)$, is not a genuine proposition *per se* but the *abstract of a judgement*, $f(a) \rightarrow \exists x f(x)$; which is to say that only a concrete judgement like 'this chalk is white' can justify the claim 'there is white chalk' – without the concrete judgement the existential claim would mean nothing. This is in particular true for general existence sentences like '$\forall x \exists y R(x,y)$', which would not be justified without the actual construction of an underlying 'law', $\Phi(x) = y$, which connects in a clearly defined way every individual x with its related y, such that we can claim the *general abstract* 'there exists a law Φ, such that for all $x R(x, \Phi(x))$' instead of the general existence sentence. What Weyl calls a 'law' is usually called a Skolem-function. Both methods, Weyl's and Skolem's, to eliminate an existential quantifier within a general clause in favour of a function connecting the individuals are closely related; the main difference lies in the way they introduce this function: Weyl requires, in contrast to Skolem, a recursive definition of the 'law' or function in question.

In the philosophy of science such a law Φ is called a *theoretical function* and the claim that such a function *exists* in regard to certain inductive generalizations (such as 'every man has a father') became known as the *Ramsey sentence* of the respective generalization. Obviously the existence claim is only justified if we can really *construct* such a function. In our little example this means that we must construct a law, as G. J. Mendel (1822–84) did, according to which we can determine the father of every person uniquely. Once we have constructed such a law of genetics we can explain why every human being has a father – in contrast to the case of bees and other insects, where the drones have no father.

In order to eliminate the 'unobservable' entities from science, Carnap later proposed

the Ramsey sentence as an *observational equivalent* substitute for a theory with certain theoretical functions α,β,γ. Such a substitute would have the same observational consequences as the original theory, yet without referring explicitly to the theoretical functions α,β,γ. The logical trick by which Carnap could achieve the desired equivalent sentence was the method of second-order quantification. He substituted the constants referring to the theoretical functions α,β,γ by a corresponding number of second-order variables α',β',γ' and binding these variables by a corresponding sequence of existential quantifiers – $(\exists\alpha')$, etc. – placed in front of the definitions and axioms of the theory. The result is the Ramsey sentence of the theory in question (*Foundations*, p. 231). However, it should be stressed that the only goal of Ramsey's own proposal was the *justification* of the general existence sentence '$\forall x \exists y R(x,y)$' by the abstract theoretical claim "There exists a function $\Phi(x)$ such that for all $xR(x,\Phi(x))$" – or, more generally, the justification of an inductive generalization with respect to certain empirical judgements by introducing a theoretical function which would explain the success of the inductive generalization. Furthermore, it is clear that this goal can only be accomplished, at least from a finitist point of view, through the *actual* construction of such a function Φ, not through a mere existence claim. Hence, Carnap's proposal to use Ramsey sentences instead of theories in order to get rid of the somehow suspicious theoretical functions is quite contrary in spirit to Ramsey's own philosophical convictions.

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ULRICH MAJER

Ramus, Peter

Peter Ramus was born in 1515 in Cuth (Vermondois) and died in 1572 in Paris. He was a French humanist, philosopher, educational reformer, and rhetorician. In his philosophical works he makes use of different schools of his time: of the humanistic critique of Aristotle, of Cicero's dialectics, of Plato's theory of ideas, and of Aristotelian and scholastic teachings – without, however, arriving at a unified system. The many revisions of his *Dialectics*, reflecting his continuous debates with his contemporaries, start from the metaphysical position of the *Dialecticae Institutiones* (1543), which rests on Platonically based presuppositions, and culminate in the *Dialecticae libri duo* (1572), a syncretistic compendium of Aristotelian dialectics and Ciceronian terminology.

Today the version of 1572 is considered as the 'Logic of Ramus' because it shaped Ramism throughout Europe. Ramus's point of departure here is 'natural dialectics' which, as a naturally given faculty of thinking, is considered a gift of God (i.e. the intellect as copy of God). Thus it must be the *a priori* basis of all thinking. This Platonic archetype finds its representation first of all in man's natural ability to reason. But it is represented also as art or doctrine, that is as the sum of the rules one has to follow in order to use this aptitude properly, and also as exercise (*exercitatio*), that is as the methodical practice of these rules.

The dialectics follows from the *a priori* presuppositions of the intellect. The theorems of its system are *a priori* reasonable, not induced from experience. As a methodically adequate discussion of problems, the *Dialecticae* begin with the 'invention', that is with the doctrine of the discovery of proofs. In the second part, Ramus attempts to give the rules for arriving at the presentation of arguments and the evaluation

of their coherence. Perfect cognition is to be reached through the three degrees of the '*iudicum*':

1. Syllogism, which as a complex of problems leads to a preliminary definition of truth as knowledge of simple states of affairs (according to Ramus dialectics arises from the confused or 'common sense' of truth which has been implemented in the human mind).
2. From the knowledge of simple states of affairs we move to a unified system of all knowledge in order to achieve clarity and order of knowledge. Method hereby leads us to the rational judgement of truth.
3. Ideas found dialectics, that is make reasonable the presuppositions of all truth (i.e. the vision of pure truth in the ideas).

After being established via a systematic insight into essence, dialectics are applied in the particular, which leads to the third part of the *Dialecticae*, the '*exercitatio*' (i.e. the exercise of reason). In the 1572 edition the Platonic theory of ideas has been dropped as the basis of the argument; the new basis is an extended Aristotelian doctrine of principles. Dialectics are now defined as a theory for discovering truth. As a result a 'logic of content' is formed, resting on the material meaning of the concepts used, and taught in applications. Ramus and his followers understand this logic as a 'fundamental scientific-theoretical instrument' (i.e. method, practice, theory of order). After his death Ramus's immediate influence affected four 'schools':

1. Ramists, who explained the doctrines of Ramus's work (e.g. Audomarus Talaeus, Franciscus Sanetius Brocensis, Rolandus Makilmenaeus, William Temple, Johannes Piscator).
2. Philippo-Ramists, who tried to reconcile the doctrines of Philipp Melanchthon with those of Ramus (e.g. Michael Sonleutner, Heizo Buschner).
3. Semi-Ramists or 'systematists', who founded a syncretistical logic (e.g. Zacharias Ursinus, Bartholomew Keckermann, Rudolphus Goclenius).
4. Logicians who analysed the difference between the teaching of Ramus and his opponents (e.g. Severinus Sluter, Johannes Riger, Paulus Frisius).

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GÜNTER SCHENK

Rationalists

Rationalism is a 17th- and 18th-century phenomenon. The most important rationalists are René Descartes, Spinoza, Gottfried Wilhelm Leibniz, and Nicolas Malebranche. Other philosophers belonging to this group are Antoine Arnauld, Arnold Geulincx, Christian Wolff, and Christian August Crusius.

The characteristic biographical feature of the four most important rationalists is that they were never professors and thus never taught philosophy at a university. Descartes and Leibniz were courtiers, and Spinoza was a craftsman. Spinoza was indeed nominated to a professorship at Heidelberg, but he did not accept this nomination. All these philosophers had, however, studied philosophy in scholastic universities: Descartes with the Jesuits in La Flèche, Malebranche at the Collège de la Marche and as a member of the Congregation of the Oratory, Leibniz with Protestant Scholastics in Leipzig, and Spinoza with rabbinic scholars. Thus it was the scholastic philosophy of the 16th and 17th centuries that formed the philosophical background and was at the same time the *pièce de résistance* of the rationalists' thinking. This dependence on scholastic thinking was in our century first shown by Etienne Gilson in his

Index Scolastico-Cartésien of 1912 and in his commentary to the *Discours de la méthode* in 1925.

One important indication of this dependence is the fact that in their writings all Rationalists use scholastic Latin – a language containing a philosophical terminology developed by analysis and distinctions over six centuries.

Innate Ideas and Inner Experience. Descartes, in his *Discours de la méthode*, was seeking for certainty, represented by clear and distinct perceptions. He does not, however, find it in metaphysics, logic, or mathematics as his predecessors did, but in inner experience. This inner experience of our own mental acts is for Descartes more certain than the perception of the external world. As example Descartes chooses the *cogito*, an act perhaps best captured by the phrase 'I am thinking' and which is characterized, like certain other cognitive mental acts, by the property of being reflexive. Thus if I think, then I think that I think; but if I hate, then I do not hate that I hate. Descartes uses this reflexivity of higher mental acts, already mentioned by Aristotle in his *De Anima* (III, 4), to infer from the existence of an act of thinking to the existence of an ego or thinking substance.

Descartes's thought is in some respects a continuation of that of Augustine, the first to have introduced the notion of inner experience into philosophy. Augustine, however, did not distrust logic in the way that Descartes did. On the contrary, he knew that logic provides us with necessary propositions and with necessary knowledge.

Intimately connected with the prevalence of inner experience in the writings of the rationalists is the theory of innate ideas. This Platonic theory, already expressed in the *Meno*, claims that the fundamental ingredients of our thinking, e.g. the ideas of substance (of God, mind, and matter), of the ego, of identity, and difference, are innate. These ideas, the materials of judgement and belief, are not dependent on experience, though their appearance can as it were be provoked by perception. Thus we can say that innate ideas are psychological dispositions, containing an ideal structure which can be revealed by thought and by perception.

The scholastic tradition knows and accepts only *ideas* as contents of the divine mind; the human mind, however, contains in addition notions or concepts which can be contradictory or to which nothing in the world might correspond. 'Ideas' here are to be understood in something like the Platonic sense. As Descartes puts it:

> Some of my thoughts are as it were the images of things, and it is only in these cases that the term 'idea' is strictly appropriate; for example, when I think of a man, or a chimaera, or the sky, or an angel, or God.

The thesis that ideas can be present in the human mind is not accepted by all rationalists. Malebranche, for example, holds that ideas are only in the divine mind, and thus all perception and cognition of the external world is mediated by God. Thus thinking and perception are only occasions for participation in the ideas in God. This occasionalism was also shared by Géraud de Cordemoy (1620–84) and by Arnold Geulincx.

Leibniz tries to find a compromise between the Aristotelian and the Platonic traditions. His formula is: *nihil est in intellectu quod non prius fuerit in sensu, nisi intellectus ipse.* (Nothing is in the intellect which was not earlier in the senses, except the intellect itself.)

Descartes's analysis was historically very successful and important metaphysical systems of the *Neuzeit* each try to achieve a synthesis between the metaphysics of Aristotle and the thinking of Augustine as revived by Descartes. This is so, for example, in the systems of Leibniz and also in those of Franz Brentano and his pupils.

Method. Characteristic of rationalist thinking is the reflection on method. Descartes favours two methods: intuition and deduction. Intuition, which is characterized by Descartes in the *Rules* as a matter of what is produced "by the light of reason alone", is the method of inner experience. It gives us first of all a direct knowledge of our own mental acts. But then also it gives us knowledge of the so-called "principles of natural light" like: "the same thing cannot be and not

be" or "nothing cannot be the efficient cause of something" and "two is even and three is odd". Characteristic of the method of intuition is that there is no room for doubt in the results that it yields.

Deduction is a mathematical, not a logical, method, and as such it is responsible for more complicated inferences. Descartes, more mathematician than logician, prefers as model for this method Euclidean geometry rather than Aristotelian syllogistic, both of which have an axiomatic structure. The universality of this method is expressed by the Cartesian term '*mathesis universalis*'.

Spinoza favours a deductive or axiomatic method. He calls it *more geometrico*, which means the way mathematicians infer, and he uses this method in his *Ethica*, his most important work. It is not surprising that his idea of a total deductive system has attracted logicians ever since.

Leibniz reveals in his works on method an Aristotelian attitude, i.e. he adapts his method to the objects he is analysing, and in contradistinction to the Cartesians he uses also induction.

With Descartes, Leibniz regards the *cognitio intuitiva* as the most perfect cognition and in his *Meditationes* of 1684 he describes this kind of cognition, which does not use symbols, as the possibility to think together and intuitively all the part-concepts of a composed concept. Thus the *cognitio intuitiva* is a kind of non-combinatoric synthesis and Leibniz's account of it is related to later theories of perception like the theories of Gestalt in the 20th century. In his later works, for example in the *Nouveaux Essais* (1703–5), Leibniz concedes that intuitive cognition is not so unusual and that we can train it, especially in mathematics and logic.

Substance and the Mind–Body Relation. A central object of reflection is the concept of substance, a concept which the rationalists took over from Aristotle via the Scholastics. The reasons for reflecting on substance are quite different among the different rationalists and therefore so also are their respective results.

Descartes is especially interested in the relation of mind and body, and opposes the spiritual substance, which he calls *res cogitans*, to the so-called *res extensa*. These two kinds of substance are represented on the one hand by human selves, and on the other hand by all non-human substances like stones, plants, and animals. This conception is quite new and can be called 'anthropocentric', in contrast to the Aristotelian cosmocentric view that had hitherto prevailed. The mechanistic euphoria of his time leads Descartes to a mechanistic conception of life: animals and plants are seen as machines, and the soul is not the principle of life.

The Cartesian conception of the relation between mind and body is rightly called 'dualistic'. But there is nevertheless for Descartes a causal relation or interaction between mind and body, serving as the foundation of sensual perception. For Descartes the *res extensa qua* substance can very well have a causal influence on the production of ideas. This thesis is compatible with the Augustinian theory of degrees of reality, also held by Descartes. Following this theory, individuals such as substances, belonging to the highest level of reality, can have a causal relation to individuals of lower levels, for example to accidents such as mental acts.

Leibniz argued in many texts against this conception. He is influenced by Descartes in the sense that he, too, renounces Aristotelian–Thomistic hylomorphism as an account of the connection of mind and body. But, like Bonaventure (1221–74), he accepts a hylomorphic structure of monads or spiritual substances. These do not have parts, but only apperceptions (or reflexive mental acts) and perceptions or (non-reflexive mental acts). Apperceptions represent the mind or active ingredient and perceptions the bodily or passive ingredient of spiritual substances.

In the world, however, there are never spiritual monads alone; every monad is related to a body, though bodies are only phenomena where minds are real. There is no causal relation between monads, but only the relation of expression or representation. The most intensive expression consists in that between a monad and its body, more intensive than that between different monads and called by Leibniz 'pre-established harmony'. Leibniz evidently subscribes to the view now called 'psychophysical parallelism'.

With Aristotle, Leibniz embraces a cosmocentric view of the world, and he thinks that there are levels of life: *anima vegetativa*, *anima sensitiva*, and *anima rationalis*. These levels are cumulative, in the sense that we share nutrition and growth with plants, and perception and memory with animals. Between human beings and animals there is only a gradual difference. Animals do not have apperceptions and consequently they have no ego, no knowledge of necessary truths, and no morality. In his *Monadology* he reproaches the Cartesians for not recognizing that animals have perceptions and memory, and that they therefore cannot be machines of the artificial sort. His main argument is a mereological one: in the case of natural machines each part is itself a machine; not however in the case of artificial machines.

A peculiar theory of substance is proposed by Spinoza. He criticizes Descartes's view of the mind–body relation, and argues that there is exactly one (necessarily existing) substance identical with God or Nature. What we normally conceive as individuals are in fact individual accidents of this single universal substance. There is an infinite number of attributes of the single world substance, but we know only the spiritual and corporeal ones, representing the *res cogitans* and the *res extensa* as different aspects of one and the same psychophysical whole.

Reductionism. There are tendencies to ontological reduction in rationalist thinking, for example the reduction of substances to their accidents or to sets of accidents. This tendency we find especially in Leibniz, who had introduced the individual concept as an epistemic analogue to the nexus of the individual substance and its accidents, containing as part-concepts all concepts under which the accidents of that substance fall. Every individual has one and only one individual concept.

There are also however certain anti-reductionist conceptions in rationalist thinking, as e.g. in the concept of the *conatus* or in-built tendency of a substance to persist. The idea of the *conatus* is first expressed in the philosophy of Thomas Hobbes, but we find it later also in Spinoza and Leibniz. For Leibniz, the substance has an organizing function in respect to its accidents; it embraces as it were a law of succession which regulates the different states or accidents of the monad as its life unfolds.

God and His Creation. A typical feature of rationalist philosophers is their interest in philosophy of theology or in theodicy. In this regard rationalism is, surprisingly, much more theologically orientated than scholastic philosophy has ever been. Spinoza and Leibniz even tried to give a metaphysical description of the world from God's perspective.

Anselm's proof for the existence of God is given new life in rationalist philosophy. The reformulation is found in Descartes's *Meditationes* and is repeated also by Spinoza. Leibniz was not content with Descartes's formulation, however. He thought that we first have to show that the concept of God is possible or without contradiction. Leibniz formulates a very sophisticated proof of God's existence on the basis of his perfections or his attributes as maximally perfect. Leibniz's proof, which employs the notion of actual infinity, was later reformulated by Bernard Bolzano and Kurt Gödel.

Ever since Origen's *De Principiis* of the 2nd century, God's creation of the world has been seen as being connected with the concept of possible worlds. Descartes, too, in his *Discours de la méthode* and in his *Principia Philosophiae*, discusses the problem of possible worlds. He thinks that God could have created other possible worlds, but that he would always have to take the same *res extensa*, the same stuff, so that he would really have created always the same world. Natural laws are necessary for Descartes: they are valid in every possible world, because there is only one *res extensa* and this is identical with the entire physical universe.

Leibniz, in contrast, holds that God has in his mind an infinity of genuinely distinct possible worlds, and that he chooses from this infinity the best, applying the minimax principle. In this decision he follows 'moral necessity', i.e. his decision is possessed of a very high degree of probability. Even the physical necessity of the world is dependent on this moral necessity. Hence Leibniz

maintains, contrary to Descartes, that natural laws are very probable but not in fact necessary.

Spinoza's theme in this context is the modal status of the creation of the world, i.e. the modality of God's action. He thinks that God created the world as a matter of necessity. Here he follows the Stoic tradition: God has to follow his nature and from this nature there necessarily results the creation of the world. This conception was present already in Peter Abelard when he says "necessary is that which is demanded by nature".

Leibniz opposes this conception. He, too, thinks that for a wise man what is obligatory and what is necessary fall together. But there is no perfect identity of these two kinds of modalities, i.e. of deontic and alethic modalities. The creation of the world is very probable and converges to absolute necessity; but it is never absolutely necessary, i.e. the contrary is always possible, even if not very probable. There is always a place for freedom of choice.

***Realitas Essentialis* and *Existentialis*.** The relation between possibility, reality, and thinkability is fundamental for rationalist philosophers. Their philosophical optimism leads to the maxim formulated by Leibniz: "*nihil aliud realitas quam cogitabilitas*" (reality falls together with thinkability).

For logical and mathematical objects this maxim is unproblematic. These depend for their existence only on the principle of non-contradiction. A composite mathematical or logical concept free of contradiction is possible or consistent and thus automatically real, and a composite mathematical or logical concept full of contradiction is impossible or inconsistent and therefore not real. But this reality is only the reality of *entia mathematica* or the reality of the *entia realia essentialia*, entities which have only essential or necessary properties.

The world of substances, accidents, and states of affairs, on the other hand, is contingent, and consequently the principle of non-contradiction is not sufficient. Leibniz therefore introduces the principle of sufficient reason which tells us why the existence of an entity is more probable than its non-existence. This principle is accordingly also called by Leibniz the 'principle of contingency'. This principle explains the structure of a contingent world containing *entia realia existentialia*.

Leibniz like Descartes believed in innate ideas; but he believed also in innate principles, i.e. the principles of non-contradiction and identity on the one hand and the principle of sufficient reason on the other. Christian Wolff later made a step backward and tried to base his whole system of metaphysics on the principle of non-contradiction alone.

The real world – as opposed to the ideal world, which is dominated by possibility as consistency – has a modal structure that is dominated by compossibility, and compossibility is characterized by Leibniz with: *compossibile est, quod non implicat contradictionem cum alio*. (Compossible is, what does not include contradiction with other things.) For Leibniz there is in God's mind a competition between compossible systems and not between individuals, and the compossible system which fulfils the minimax principle is chosen by God and identical with our world. The competition between compossible systems is decided by the principle of the best. Thus *entia realia existentialia* depend on a certain compossible system which is their context. They do not exist in an isolated way.

Mathematics and Logic. The philosophy of mathematics and logic is intensively discussed by the rationalists. The Cartesians, represented by Descartes and Malebranche, always defended the view that algebra is the basic mathematical discipline in the sense that other mathematical disciplines and logic are dependent upon it. Leibniz opposes this view, and he is convinced that there is a basic or fundamental formal discipline belonging to metaphysics, a discipline which embraces both mathematics and logic, and which he calls "*characteristica universalis*".

In spite of all their work on method, only Leibniz among the rationalists was seriously interested in logic and his contributions to the discipline rank with those of Aristotle, George Boole, Gottlob Frege, and Gödel. Leibniz was not only the first to develop logical calculi, he was also active in applying logic to metaphysics, and his most abstract

calculi can be interpreted both in a set-theoretical and in a modal and mereological manner.

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HANS BURKHARDT

Raymond Lull

With thinkers like Anselm of Canterbury, a new dynamic understanding of reality appeared in the West. Although this understanding was submerged for a time by the effort to recover Aristotelian science, it surfaced again in many forms around the beginning of the 14th century. One of the most important figures in this evolution was that of the Majorcan polymath, Raymond Lull (*c.* 1232–1316). Working at the frontier between Islam, Judaism, and Christianity, Lull sought by means of a new science – the renowned *Ars lulliana* – to convince all peoples of the truth of Christianity. Because this science was addressed to all faiths, it should not be specifically theological, but rather a general science which could be applied to all the particular sciences of his time.

Behind this general science there lay, however, the fundamental vision of a natural theology which should approach the true God through a method of contemplation on the divine names. Lull called these names 'dignities' or 'axioms' and listed in the final form of the Art nine of them: goodness, greatness, eternity; power, wisdom, love; virtue, truth, and glory. His idea seems to have been based on an Islamic method of contemplation which attempted to ascend by way of created reflections of the divine perfections to the infinite perfection which is God himself. He thought that through contemplation on combinations of these names, which are common to all religions, agreement could be reached between Moslems and Jews, Greek and Latin Christians.

One recognizes the Neoplatonic *Bonum est diffusivum sui* behind goodness as the first of the dignities, perhaps the 12th-century triad of *potestas, sapientia, benignitas* behind the second group of three divine names, and – most importantly – Anselm's *id quo maius cogitari nequit* behind the inclusion of greatness. But Lull's inspiration for the way in which these names are to be understood seems to have been taken from Islamic mystical writers. He tells us that Moslems believe that God has placed even more power in his names than in animals, plants, and precious stones. His method of contemplation can, therefore, only be understood correctly if we take the dignities to stand for the active powers in things which must be referred to the supreme power of the Creator.

Accordingly, Lull developed his method of contemplation not only by spelling out – horizontally, so to speak – nine different names of God, but also by making explicit – vertically – three degrees of the powers of the names. He conceived his Art as a means of intellectual ascent which proceeds by way of two stages: a transcending of sense-knowledge by an ascent from the positive to the comparative degree of the dignities (*bonum – melius*), and a transcending of rational knowledge by an ascent from the comparative to the superlative degree (*melius – optimum*). On this level of eternal truth the multiplicity and differences encountered on the first two levels disappear. In God it is no longer possible to distinguish the best from the greatest or the most powerful. At the superlative degree of reality the mystic discovers the supreme being in whom all the divine names coincide or fall together.

But Lull went even further in his analysis of what it means when we say that the powers of the divine names are active. He held that we can not truly call something good which does

not produce a good. Because action presupposes a principle or source, that which is produced, and a bond between them, he spoke not only of dignities but also of their acts and the 'correlatives' of action. As he explained: "*Actus . . . bonitatis dico bonificativum, bonificabile, bonificare; actus etiam magnitudinis sunt magnificativum, magnificabile, magnificare; et sic de aliis omnibus divinis dignitatibus*". Lull generalized this idea to the extent that he could speak even of the abstract moments of activity as *-tivum*, *-bile*, and *-are*. He defined these moments as the substantial and intrinsic principles of action valid for all reality.

In this way Lull was able to recognize images of the triune God in all aspects of the created world – in the form, subject, and property which make up the nature of the angels and in the form, matter, and conjunction which constitute material things. He was aided in his purpose by the analysis of the knowledge of the illuminated mystic current among some Moslem thinkers who understood Aristotle's description of God as νόησις νοήσεως as an analogy for the mystical knowledge in which knower, the object known, and the act of knowing itself are one. Lull was able to join this analogy with Augustine's famous comparison of the Trinity with human love. In his *De amic e amat* he maintained that true, active love presupposes a lover, the beloved, and the love itself which unites them.

Because the correlative principles are intrinsic to all activity, it follows that for Lull it is not being, but activity and relatedness which are the absolute ontological principles. Even the divine unity known through faith must be structured; as an active unity it must have a moment which is to be united. Accordingly, Lull added, in the later forms of the Art, nine relative dignities to the absolute ones: difference, contrariety, concordance; greaterness, lesserness, equality; beginning, middle, and end. Contrariety and lesserness are found in the created world, but on the superlative level of the divine activity there remain only equality and concordance. The divine *optimans* can only produce a divine *optimatum* which is its equal; the difference between them must be transcended in the concordance which is a divine *optimare*, the three forming the beginning, middle, and end of all things.

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CHARLES H. LOHR

Realism, Scientific

Scientific realism is a label which has been used for a variety of different philosophical views about scientific knowledge. Common to these views is the *ontological* thesis that there exists a reality independent of human minds, and the *epistemological* thesis that scientific theorizing (even when it transcends the boundaries of the observable) is a good or the best method for gaining knowledge about the mind-independent reality. In opposition to naïve or dogmatic forms of realism, 'critical' scientific realists further maintain that even the most advanced results of scientific enquiry are never certain or completely true, but at best 'approximate' and 'approach' the truth.

The roots of scientific realism go back to the critical, dynamic, empiricist, fallibilist, and evolutionary epistemologies of the 19th century – such as C. S. Peirce's pragmatism and Friedrich Engels's (1820–95) dialectical materialism. In the 20th century, the demise of logical positivism was followed in the 1950s by the rise of scientific realism (Karl Popper, J. J. C. Smart, Wilfrid Sellars, David Bohm, Hilary Putnam, Mario Bunge, Rom Harré), but the tide of neo-pragmatism in the 1970s has made anti-realist views fashionable once more (Thomas Kuhn, Paul Feyerabend, Larry Laudan, Nelson Goodman, Michael Dummett, Putnam, Richard Rorty, Bas van Fraassen).

The ontological position of scientific realism is opposed to all forms of subjective idealism (such as solipsism and phenomenalism). On the other hand, the minimal thesis that at least part of reality is independent of human minds can be combined with reductionist materialism or physicalism (Smart, Armstrong), emergent materialism (Engels, Popper, Bunge), mind–body dualism, or even objective idealism (Peirce, Bohm). It is compatible with nominalism (Sellars) as well as 'scholastic' realism about universals (Peirce, Armstrong), or with object ontology as well as process (Popper) or system ontology (Bunge). Further, it may, or may not, assert the reality of potencies (Harré).

Scientific realists typically are *semantic realists*: they define truth in terms of a correspondence relation between language and reality (formally explicated in Alfred Tarski's model-theoretic account of truth), and distinguish a definition of truth from the epistemic indicators of truth. Thus, truth about the mind-independent reality is also independent of our knowledge and beliefs. Sellars prefers to define truth in terms of assertability within a language, but his concept of 'picturing' reintroduces a language-world relation.

Metaphysical Versus Internal Realism. Putnam distinguished in 1977 between *metaphysical* and *internal realism*. The former regards truth as a radically non-epistemic notion, while the latter defines truth as ideal rational acceptability. In this sense, internal realism is a variant of the philosophical position which, unlike semantic realism, defines truth in epistemic terms – and so is allied with pragmatism, verificationism, mathematical intuitionism, and the consensus theory of truth.

According to Putnam, metaphysical realism presupposes a unique 'ready-made' world and a privileged conceptual framework for describing its structure, while internal realism insists that the world can be 'carved into pieces' in several alternative ways. Internal realism thus opposes all ontological and epistemological versions of the 'Myth of the Given'. Raimo Tuomela's variant of internal realism is based on his *scientia mensura* principle: the ultimate results of science, the best-explaining theories, are the arbiters as to what there is. Ian Hacking has characterized Putnam's new position – all naming and classification of objects is imposed by our languages and theories – as "transcendental nominalism".

The semantic realist may accept the fact that the world can be described by alternative conceptual frameworks, but he will insist that it is still the world itself (rather than we or our epistemic states) which decides the truth of such descriptions.

Realism and Truth. Further, while a semantic realist denies a definitory or analytic connection between being true and being knowable, he will urge that the method of science is self-corrective and truth-producing in the long run. Even if our observations and best theories are corrigible or can fail to be true (as fallibilism claims, against the naïve realism of classical empiricism and rationalism), scepticism and Kantian agnosticism can be avoided, since science is able to approach the truth. The best explanation for the practical success of scientific theories is the hypothesis that they are true or at least sufficiently 'close to the truth'. The use of the systematic methods of science at least makes it highly probable that the scientific community will eventually reach truth-like or approximately true information about reality. These intuitive ideas (Peirce) have been explicated by contemporary realists with the aid of the concept of verisimilitude (Popper, Pavel Tichy, Graham Oddie, Ilkka Niiniluoto).

As a doctrine about scientific theories, scientific realism claims that theories are true or false attempts to describe reality. In particular, postulates about the existence of unobservable theoretical entities have a truth-value – and may receive indirect support from the empirical success of the theory. Thus, scientific realism is here opposed to descriptivism (Ernst Mach, the early Vienna Circle), which regards theories as merely economical descriptions of the phenomena, and to instrumentalism (Pierre Duhem, Henri Poincaré), which treats theoretical statements as uninterpreted symbolic tools for observational prediction and systematization.

Some scientific realists share with instrumentalism the view that theoretical laws have no truth-value, but still endorse 'entity real-

ism', i.e., they accept the existence of theoretical entities by appealing to the success of the experimental practice in science (Harré, I. Hacking, Nancy Cartwright).

Some philosophers of science accept that theories have a truth-value, but still come close to anti-realist instrumentalism by claiming that truth is methodologically irrelevant: the virtues of scientific theories and research programmes should be analysed by their predictive power, empirical adequacy (van Fraassen), simplicity, or problem-solving ability (Kuhn, Laudan). Against this view, scientific realism claims that truth (with information content and explanatory power) is an essential element of the cognitive aims of science.

See also: **Idealism/Realism**

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ILKKA NIINILUOTO

Reductionism

The general idea of 'reductionism' is a very old one (cf. e.g. the notion of a *reductio ad absurdum* proof). The expression 'reduction' has however been used in a number of quite different connections. In this century Edmund Husserl introduced the concept of 'eidetic reduction' (or bracketing of existence) and of 'phenomenological reduction' (or cancelling of the natural attitude). More important today is Rudolf Carnap's assertion according to which there is:

> a *unity of language* in science, viz. a common reduction basis for the terms of all branches of science, this basis consisting of a very narrow and homogeneous class of terms of the physical thing-language (*International Encyclopedia of Unified Science*, 1938, p. 61).

For Carnap, then, terms like 'red', 'hot', 'small', 'anger', etc., would be reduced to 'observable thing-predicates'.

There is no general consensus in contemporary philosophy about the concept of reduction and as to how reductions are to be performed. Two broad tendencies can be distinguished: either an item X is totally eliminated when reduced to (or by) an item Y; or (the reduced) item X continues to have some place or play some role in (the reducing) item Y. In general, the understanding and application of the concept of reduction is situated somewhere between these two positions.

Reductions occur in widely different areas, of which the most important are:

1. the ontological area: entity X is reduced to entity Y;
2. the conceptual area: concept f is reduced to concept f';
3. the linguistic area: expression e is reduced to expression e';
4. the theoretical area: theory T is reduced to theory T' (e.g., Newtonian mechanics to Einsteinian mechanics, chemistry to physics);
5. the logical area: a procedure or structure is reduced to another procedure or structure.

Of these five areas, the most fundamental questions concern the ontological. All other types of reductions imply in some form or other an ontological reduction of a conceived (or expressed or theoretically articulated) entity X to (or by) another entity or type of entity Y.

On one problematic formulation, ontological reduction is seen as a procedure which

presupposes the existence of an entity (or category) X and of an entity (or category) Y, and then seeks to displace X in favour of Y. But if entity X really exists, then it cannot be eliminated *simpliciter*. It can at best be ignored with respect to some goal or perspective.

One can distinguish a strong and a weak conception of ontological reduction. The *strong* conception implies a change or shift in ontological attitude towards the reduced entity X. Implicit in this conception is the presupposed existence of both the reduced and the reducing entity. If a mental entity X is reduced to a physical entity Y in this sense, then it is assumed that both X and Y really do exist.

According to one version of strong reduction, the reduced entity is somehow *incorporated* into the reducing entity. A variant of strong reduction in this sense is the classical account of intertheoretic reduction according to which a new theory reduces an older theory just in case the new theory, conjoined with appropriate bridge laws, logically entails the principles of the older theory (cf. Nagel 1961). By means of the bridge laws or correspondence rules the disparate ontologies of the two theories are *connected*. (This connection can be expressed via an identity statement, such as temperature = $mv^2/3k$; in these terms it seems more appropriate to take this classical account as a kind of weak reduction (see below).)

According to another account of strong reduction, however, which recalls the discussion of supervenience in the philosophy of mind, the reduced and the reducing entities are each assigned to different ontological domains or worlds. This necessitates the acceptance of and accounting for an ontological plurality of domains or worlds. The strong conception of reduction on this second account amounts to abandoning or ignoring a (kind of) entity belonging to one domain or world in favour of another (kind of) entity belonging to a different domain or world.

The *weak* conception of ontological reduction also involves a change or shift. Here, however, the shift does not occur in the ontological dimension, but rather in the dimension of the linguistic expression or theoretical articulation of our knowledge concerning an entity. The entity itself remains unchanged or unshifted.

There seem to be *three* possible readings of this epistemological shift. The *falsity* or *mistake account* sees it as the *replacement* of a wrong conception (or expression or theoretical articulation) by a more correct one. Reduction means elimination of the false conception (or of the mistaken expression or theoretical articulation). This position seems to rely on the presupposition that the entities talked about are completely independent of our mind, language, conceptual schemes, and theories. It appears inadequate to speak of reduction in such a case, however, since reduction does not mean the same as elimination.

The *arbitrariness* account of weak reduction, on the other hand – a reading defended, for example, by Paul Feyerabend – understands the reductive shift as the replacement of a conception (or linguistic expression or theoretical articulation) by another on an arbitrary basis: both the reducing item and the reduced item are assigned the same degree of acceptability (or even of 'truth' in some sense). This concept of reduction assumes that the two items are incommensurate and that therefore a reduction can only be performed for external (or contingent) reasons. To reduce is to choose. This understanding of reduction seems to be presupposed, for example, by those authors (like Thomas Kuhn) who take theories to be incommensurable and yet still reducible to each other. The ontological implications of this position, if explored, are considerable. But it clearly fails to capture the intuitive understanding of reduction.

Finally, the *adequacy* account of weak reduction understands the reductive shift as the replacement of one conception (or linguistic expression or theoretical articulation) by another *more adequate* one. This understanding presupposes that a notion of increasing ontological adequacy among concepts (linguistic expressions, theories, disciplines) can be worked out. This seems to be the most acceptable concept of weak reduction.

Are the conceptions of strong reduction and weak reduction mutually exclusive? And

how might the relation of increasing ontological adequacy be exactly understood? To these and to similar questions one can find no clear answer in contemporary philosophy. In general, attempts to determine the concept of reduction are limited to standard formulations which symptomatically do not address these problems. The following passage of W. V. O. Quine illustrates this omission. He distinguishes two kinds of reductive reinterpretation. The first enables us "to dispense with one of two domains and make do with the other alone". The second is of:

> the sort where we save nothing but merely change or seem to change our objects without disturbing either the structure or the empirical support of a scientific theory in the slightest. All that is needed in either case, clearly, is a rule whereby a unique object of the supposedly new sort is assigned to each of the old objects. I call such a rule a proxy function. Then, instead of predicating a general term '*P*' of an old object *x*, saying that *x* is a *P*, we reinterpret *x* as a new object and say that it is the *f* of a *P*, where '*f*' expresses the proxy function (Quine 1981, p. 19).

Quine adds that "the original objects have been supplanted and the general terms reinterpreted". He speaks of a "revision of ontology" and the conclusion he draws from this is the inscrutability of reference. But it is, of course, by no means clear what is meant by expressions like "old objects", "supplantation", "reinterpretation", and the like.

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LORENZ B. PUNTEL

Reference

Many questions of a metaphysical and ontological nature are intimately connected to questions about reference. Typically, reference is taken to be a relation between expressions of a language and entities in the world. Consider the following sentences:

(1) Bertrand Russell was British.
(2) Paris is in France.

In these sentences there is a natural division between the grammatical *subject* and the grammatical *predicate*. How do the meanings of these two major grammatical components contribute to the meaning of the sentence as a whole? The following seems plausible: the subject noun phrase – here a proper name – *refers* to some individual, and the predicate *attributes* some *property* to that individual.

Sentences like (3) and (4), although superficially of subject-predicate form, do not appear to function in this way:

(3) No Englishman has been into space.
(4) Every politician is a crook.

Following the lead of Gottlob Frege, it is customary to provide *quantificational* analyses of such sentences. If we remove overtly quantified phrases from the class of noun phrases we seem to be left with a class admitting of the following major divisions: proper names ('Russell', 'Paris', etc.), personal and impersonal pronouns ('she', 'her', 'herself', 'you', etc.), demonstrative pronouns ('this', 'that'), definite descriptions ('the first man into space', 'the positive square root of 4'), indefinite descriptions ('a man', 'a man I met last night', etc.), and demonstrative descriptions ('that man', 'that man in the corner', etc.). Several interconnected questions now arise. Are all of these expressions *referential*? How do those that are referential *come to refer*? Does the referent of a referential expression exhaust its *meaning*?

According to Frege in his paper "On sense and reference", a theory of reference is inadequate as a complete theory of meaning because of the possibility of informative identity statements, vacuous names, and the failure of substitutivity of co-referring expressions in certain linguistic environments. Consider (5) and (6):

(5) Cicero = Cicero.
(6) Tully = Cicero.

Frege argued that these sentences must differ in meaning because only (6) is informative and that 'Cicero' and 'Tully' must therefore differ in meaning despite having the same referent. His case was furthered, he thought, by the fact that substitution of 'Tully' for 'Cicero' will not always preserve truth:

(7) Bill believes that Cicero wrote *De fato*.
(8) Bill believes that Tully wrote *De fato*.

Even though (6) is true, (7) and (8) may differ in truth-value.

Such considerations led Frege to distinguish between the *reference* and the *sense* of an expression. For Frege, a sense is an objective entity – to be distinguished from a subjective *idea* – that determines the expression's referent. For instance, the sense of the name 'Cicero' might be characterized using a definite description such as 'the greatest Roman orator', in which case, the referent of 'Cicero' will be the unique individual satisfying this description.

On Frege's account definite descriptions themselves are treated just like names. However, Bertrand Russell in "On denoting" presented arguments for the view that descriptions are really quantified expressions and not genuine referential expressions. A variety of interconnected ontological, epistemological, and semantical considerations lie behind this claim. Take the following sentences:

(9) The largest prime number lies between 10^{23} and 10^{27}.
(10) John thinks that the largest prime number lies between 10^{23} and 10^{27}.
(11) Mrs Jones wants Mary to marry the king of France.

How are we to treat 'the largest prime number' and 'the present king of France', which fail to single out objects? Since (9)–(11) might be used to make meaningful assertions, it simply will not do to say that they are meaningless.

On Frege's account, the occurrence of 'the largest prime number' in (9) has no referent and hence the sentence as a whole has no truth value, a conclusion which conflicts sharply with the intuition that the sentence is false. (Frege does not face this problem with (10) and (11) because he takes a name occurring in the context of a psychological verb to refer to its customary sense.) One approach to non-referring expressions would be to posit a realm of non-existent entities to serve as their referents. This approach was taken by Russell in some of his works and especially by Alexius Meinong, *Untersuchungen zur Gegenstandstheorie und Psychologie*, Leipzig: Barth (1904). But by 1905 Russell felt that this position conflicted with a "robust sense of reality", and his famous Theory of Descriptions came about, in part, as an attempt to purify his ontology. According to Russell, if a singular noun phrase R can be supposed not to refer, yet a sentence containing R still be supposed to express a determinate proposition, then R cannot be a genuine referring expression. Whenever we face this state of affairs, the Theory of Descriptions provides the sentence in question with a quantificational analysis, i.e., an analysis in which there is no 'logical subject'. Informally, we may state the main thesis of Russell's theory thus: If 'the F' is a definite description and '( ) is G' is a predicate phrase, then the proposition expressed by an utterance of 'The F is G' is logically equivalent to the proposition expressed by an utterance of 'There is one and only one F, and everything that is F is G'. That is, 'The F is G' is treated as equivalent to

$$(\exists x)(Fx \;\&\; (\forall y)(Fy \supset y = x) \;\&\; Gx).$$

On this account, a sentence like (9) is straightforwardly false as there is no largest prime number. As Russell noted, his analysis opens up the possibility of accounting for certain *de dicto–de re* ambiguities in terms of scope permutations. For example, (10) above may be represented as either (12) or (13), according as the description 'the largest prime number' is given wide or narrow scope with respect to 'John thinks that':

(12) $(\exists x)$(largest-prime x & $(\forall y)$(largest-prime $y \supset y = x$) & John thinks that: (x lies between 10^{23} and 10^{27})).

(13) John thinks that: $(\exists x)$(largest-prime x & $(\forall y)$(largest-prime $y \supset y = x$) & x lies between 10^{23} and 10^{27}).

(12) is false because there is no largest prime; but (13) could still be true. Similarly with (11); there is no king of France (at present), so (11) is false on the *de re* reading that results from giving the description 'the king of France' wide scope. But (11) may express a truth on the *de dicto* reading that results from giving the description narrow scope. Thus Russell is able to avoid positing an ontology that includes such things as a largest prime, a king of France, a round square, and so on, and at the same time he can treat a sentence like (9) as expressing a perfectly determinate proposition. The proposition is *object-independent* in the sense that there is no object for which its grammatical subject stands, upon which the existence of the proposition expressed depends. Unlike a genuine referring expression, a definite description 'the F', although *it may* in fact be satisfied by a unique object, does not actually refer to that object. Sentences containing descriptions are *quantificational*.

As pointed out by A. F. Smullyan (1948), Russell's theory can also be used to explain the *de dicto–de re* distinction as it arises in modal contexts. For example, (14) is ambiguous between (15) and (16):

(14) The number of planets is necessarily odd.

(15) Necessarily $(\exists x)(x$ numbers the planets & $(\forall y)(y$ numbers the planets $\supset y = x)$ & x is odd).

(16) $(\exists x)(x$ numbers the planets & $(\forall y)(y$ numbers the planets $\supset y = x)$ & Necessarily (x is odd)).

(15) is false – there might have been, say, six planets – whereas (16) is true, on the assumption that 9 is necessarily odd. As Smullyan observes, substitutivity problems simply do not arise in modal contexts if one accepts Russell's view that descriptions are devices of quantification rather than reference.

P. F. Strawson (1950) argues that referring is something that *speakers* (rather than expressions) do, and that, partly as a result of this, Russell's quantificational analysis of sentences containing descriptions does not do justice to the ways descriptions are actually used. According to Strawson, when one uses a description 'the F' one typically intends to *refer* to some object or other (usually an F) and say something about it; there is no question of claiming that some object uniquely satisfies F. Consideration of the behaviour of descriptions in non-extensional contexts (e.g., attitude, modal, and temporal contexts) and the possibility of misdescribing an individual but successfully communicating something about that individual, have led many authors to suggest that neither Russell nor Strawson had the whole story: sometimes descriptions are quantificational, at other times they are referential. (See, e.g., Rundle 1965, Donnellan 1966.) But Saul Kripke (1977) has demonstrated that (1) no quantificational/referential distinction can replace Russell's notion of the scope of a description, and (2) so-called referential uses of descriptions can plausibly be accommodated by invoking an antecedently motivated Gricean distinction between *semantic reference* and *speaker's reference*, the latter being of relevance to the theory of *communication* but not to semantics itself.

Russell went on to extend his Theory of Descriptions to cover ordinary proper names, which he views as 'disguised' or 'truncated' descriptions. For instance, the name 'Cicero' might be unpacked as the description 'the greatest Roman orator'. On the face of it, this provides Russell with accounts – not dissimilar from Frege's – of why (5) and (6) differ in informativeness, and of why (7) and (8) need not agree in truth value: 'Tully' and 'Cicero' are unpacked as *different* descriptions. But in the light of Kripke's (1972) seminal work on names, it is now widely held that descriptive analyses of proper names cannot succeed. That names cannot be disguised descriptions is best illustrated by thinking about counterfactual circumstances. Let us grant that the name 'Cicero' abbreviates some description or other, say, 'the greatest Roman orator'. Then on Russell's account, (17) will be equivalent to (18):

(17) Cicero was bald.

(18) The greatest Roman orator was bald.

On the assumption that Cicero was in fact the greatest Roman orator, the actual truth conditions of (17) agree extensionally with those of (18). But as Kripke points out, in *counterfactual* circumstances they may differ. Suppose someone other than Cicero was in fact the greatest Roman orator; the truth of (18) would depend on whether or not *that other person* was bald; but the truth of (17) would not depend upon how things are with that individual, it would depend upon how things are with *Cicero*. For Kripke a proper name is a *rigid designator*, i.e., an expression that refers to the same individual in every possible world in which that individual exists. (A consequence of this is that, unlike definite descriptions, proper names in modal contexts do not give rise to the type of scope ambiguity illustrated by (14)–(16) above.) Although some descriptions turn out to be rigid because of the predicates they contain – for instance 'the positive square root of 4' – unlike names, descriptions are not *by their very nature* rigid. The description 'the greatest Roman orator' may well pick out Cicero in this world. But things would doubtless have turned out otherwise if, say, Cicero had decided to become a carpenter, or had died at birth. In such circumstances 'the greatest Roman orator' picks out someone other than Cicero.

David Kaplan (1977) has argued that demonstrative expressions like 'this' and 'that', indexical pronouns like 'I' and 'you', and demonstrative occurrences of personal pronouns like 'he' and 'she', are also rigid designators. Since these expressions are context-sensitive, in order to see that they are rigid, one must be careful to distinguish the context of utterance from the possible world at which the proposition expressed is evaluated for truth or falsity. Suppose I point to someone at a party and say to you:

(19) That man is a spy.

The referent of the demonstrative 'that man' is the person I am demonstrating in the context of utterance. However, we do not want to say that the description 'the man I am demonstrating' gives the meaning, or fixes the referent of 'that man' (as used on this occasion). The proposition expressed by (19) is true at worlds in which I never point during my lifetime. And descriptions such as 'the man I am talking about' or 'the man I have in my mind' will not do because the proposition expressed by (19) is true at some worlds in which (e.g.) I never utter a word or think about anyone. A sentence of the form 'That F is G' is semantically very different from a sentence of the form 'The F is G'. Whereas 'that F' is a rigid designator, 'the F' need not be.

The semantical and ontological concerns that drove Russell to distinguish between genuine referring expressions and definite descriptions crop up again with pronominal reference. While some occurrences of personal pronouns are rigid referring expressions, there are *anaphoric* occurrences that are not. (Let us say that a pronoun α is anaphoric on a phrase β iff α depends for its interpretation upon the interpretation of β.) Pronouns anaphoric on referential expressions, as in (20) and (21), do seem to be referential:

(20) *John* went to see *his* mother.
(21) *That man* is a spy. *He* tried to bribe me.

But pronouns anaphoric on quantified phrases must be handled rather differently. It is customary to treat the pronouns in examples like (22) and (23) as bound variables, in the manner familiar from the predicate calculus:

(22) *Some man* loves *his* mother.
(23) *Every man* loves a woman who loves *him*.

However, G. Evans (1977) has shown that not all pronouns with quantified antecedents can be treated in this way. Consider:

(24) John bought *some donkeys* and Harry vaccinated *them*.

If the pronoun 'them' in (24) is treated as a variable bound by 'some donkeys', the logical form of the sentence will be:

(25) $(\exists x)$(donkey x & John bought x & Harry vaccinated x).

But this is incorrect; (25) can be true even if Harry did not vaccinate all of the donkeys John bought, whereas (24) cannot. For example, if John bought ten donkeys and Harry vaccinated only two of them, (25) would be true whereas (24) would not.

Evans notes that a plausible paraphrase of (24) is (26):

(26) John bought *some donkeys* and Harry vaccinated *the donkeys John bought.*

This suggests that it might be possible to analyse the unbound anaphor as going proxy for a plural description recoverable from the clause containing its antecedent. Similarly where the antecedent is singular as in (27) and (28):

(27) John bought *a donkey* and Harry vaccinated *it.*
(28) *Just one man* drank rum at my party and *he* was ill afterwards.

We might interpret 'it' as 'the donkey John bought' in (27), and 'he' as 'the man who drank rum at my party' in (28). (Bound analyses again deliver the wrong truth conditions.) On Evans's original account, it should be noted that such pronouns – "E-type" pronouns as he calls them – do not actually *go proxy* for descriptions but have their *references rigidly fixed* by them. However, it is now widely held that the proxy view is preferable because it allows for the possibility of pronouns taking narrow scope in sentences like the following:

(29) *A man* murdered Smith. The police have reason to think *he* injured himself in the process.
(30) Hob thinks that *a witch* killed Trigger. He also suspects that *she* blighted Daisy.

There is a reading of (30) that can be true even if there are no witches. Suppose Hob thinks there are witches and has been led to believe that a witch killed Trigger. Suppose he is then led to believe that a witch blighted Daisy and that *one* witch is responsible for both acts. The proxy view allows the pronoun 'she' to be interpreted as a definite description 'the witch that killed Trigger' and given *narrow scope.* Russell's insights concerning overt descriptions carry over to pronouns interpreted as descriptions, and again we are assured a sensible interpretation of a sentence containing a non-denoting expression without ontological inflation.

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STEPHEN NEALE

Reichenbach, Hans

Hans Reichenbach, philosopher of science, was born in 1891 in Hamburg. He studied engineering, physics, mathematics, and philosophy. In 1926 he became professor for philosophy of physics in Berlin. He was in close contact with Moritz Schlick (1882–1936), Rudolf Carnap, and the Vienna Circle, and was one of the editors of the common Berlin–Vienna journal *Erkenntnis*. In 1933 he had to leave Germany and taught in Istanbul until 1938, when he moved to Los Angeles. There he stayed until his death in 1953.

Reichenbach's philosophy was dominated by the breakdown of Kantian metaphysical principles in the revolution of physics in the first decades of our century. He was deeply impressed by Albert Einstein's (1879–1955) two theories of relativity and later by quantum mechanics. The new physical theories clashed with Euclidean geometry, with determinism and with some other venerable metaphysical principles, which had until then been considered indispensable tools for science. Reichenbach, however, had learned from Kant that knowledge about objective things in the world is more than a report on observed phenomena or sense impressions. According to Kant, it is the synthetic *a priori* principles which have to be combined with sense-data in order to yield experience. Reichenbach replaces these by additional principles and definitions. In order to talk about more than sense-impressions, about objective reality, we have either to introduce new terms (as for instance 'length', 'time', 'simultaneity') by "coordinative definitions", or to postulate "coordinative principles" (1920) or "extension rules" (1951).

Can there be a conflict between such principles and the observations of scientists? Reichenbach's argument proceeds on three lines.

1. The principles, rules or definitions are neither self-evident nor derivable from *a priori* premisses. We are not forced by a kind of metaphysical intuition to believe some principles rather than others. Thus we may imagine a world in which rigid bodies and light rays behave like measuring rods and straight lines in spherical geometry. Reichenbach tries to free his readers from the apparent pure intuition of Euclidean geometry by describing possible experiences in a non-Euclidean world. He tries to explain geometrical intuition in terms of a psychological mechanism which leads us to expect with absolute certainty what in fact is only implied by our favourite conventions.
2. Some of the principles are "coordinative definitions". Length, for instance, is defined by the transport of rigid measuring rods which are called 'rigid' if they are not affected by "differential forces". These are forces which cannot be screened off and act differently on different bodies. But some other principles, like for instance the "principle of Euclidean geometry", are of a different kind. They belong to the "extension rules" which also extend the language from the observed phenomena to objects assumed for their explanation. They are more than mere definitions. Some of them may, in combination with empirical observations, come to contradict others and the "coordinative definitions", and thus they may clash with experience, as was the case for the extension rules of classical physics. Thus physics may lead to a change in our world view.
3. Not only coordinative definitions but also extension rules may be replaced by others leading to "equivalent descriptions" of the world. For the description of the microworld of atoms and electrons, two-valued logic and the principle of action by contact together are not compatible with the observed phenomena. But we may, for example, replace the principle of action by contact with a principle which allows for causal influence spreading with arbitrary high or even indefinite speed, or we may replace two-valued logic by three-valued logic (using a third truth value 'indeterminate'). In the first case we obtain a wave description of the microworld leading to causal anomalies, such as instantaneous changes of the waves which arise when the position of an electron is measured. In the second case causal anomalies are avoided at the price of a non-standard logic. These different descriptions of the world are both compatible with the same possible phenomena and in this respect equivalent. We cannot claim, as some dogmatic realists have done, that from two different empirically equivalent descriptions the simpler or more economical one is more likely to be true.

If two descriptions of the world, one simpler than the other, are compatible with the same past, present, and future phenomena, they do not differ except in "descriptive simplicity" and may both be true at once. They are only descriptions of the same facts in two different languages. If, however, two descriptions, both compatible with the same known phenomena, differ in the predictions they make for possible experiments, inductive reasoning yields that the simpler is more likely to be true, since in this case the theories differ by "inductive simplicity" which *is* relevant to truth.

If all coordinative principles of knowledge are (more or less) conventional, what about the principle underlying inductive reasoning? In 1925 Reichenbach called this principle the "principle of probability". It could not be conventional by itself, since this would have made induction an arbitrary procedure. In the 1920s Reichenbach believed it to be a "metaphysical principle". At that time he could have been classified as a *probabilistic logical empiricist* for whom knowledge rests on three pillars: induction, logic, and observations. In 1933 or somewhat earlier, he had the idea that the whole theory of induction may be derived from one single proposition, the "principle" or "rule of induction". It says that it is rational to assume that if events of a certain kind have appeared h times in a series of n events they will appear in the long run approximately in h of n cases or with probability $p = h/n$. He believed himself to be able to show that the principle is a necessary precondition for any kind of systematic experience. He did not, however, consider this argument as a kind of transcendental deduction in the sense of Kant but rather as a pragmatic justification, since he did not claim to have *proved* the principle by this reasoning. From 1933 on he rather claimed to be a *logical empiricist* who believed in nothing except in logic and empirical observations. One has merely to accept the principle as a guide for action.

Thus 'knowledge', strictly speaking, i.e. scientific theories and the hypotheses of prescientific knowledge, is not *known* at all but only taken for granted as a basis for practical action.

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ANDREAS KAMLAH

Reid, Thomas

Thomas Reid was born in Strachan, near Aberdeen, in 1710 and died in Glasgow in 1796. Many of his contributions to philosophy and psychology derive from his criticisms of the uses made of 'ideas' (mental tokens) by his contemporaries and predecessors. He rejects the view that "the immediate object of thought is always some impression or idea". Reacting to David Hume's sceptical conclusions, he understands that a fundamental flaw is involved in the admission of such mental tokens. The debate launched by Reid is not merely epistemological, however, but bears on doctrines that have ontological import, especially in the philosophy of mind and action. Reid's views prove astonishingly modern and have often been restated in 20th-century philosophy. (Quotations are from *Works*, 8th ed., 1895, Edinburgh: J. Thin; repr. 1983, Hildesheim: Olms.)

Mental Activity without Ideas. In his many-sided discussion of mental activity, Reid adopts a distinction between act and object: "In perception, in remembrance, and in conception, or imagination, the act of the mind about its object is one thing, the object is another thing" (*Essays on the Intellectual Powers of Man*, 1785, 292b). This expresses the notion of intentionality (directedness upon an object) of mental acts. But unlike Franz Brentano, Reid does not conceive of intentionality as the distinguishing character of mental phenomena, since he holds that sensations lack it.

Perception. In his *Inquiry into the Human Mind* (1764), which deals with the phenomena of sense-perception, he distinguishes between 'perceptions', which have an object distinct from the act, and 'sensations', which have none – pain being here the paradigm

case. The function of objectless sensations is to serve as 'natural signs' of the qualities of a perceived thing. Specific sensations naturally 'suggest' the various contents of perception. Among the qualities one thus attributes to the thing perceived, some are *primary*, in the sense that a thing's having them occasions sensations that 'suggest' knowledge of the thing's structure to us, while others are *secondary*, in the sense that no such knowledge is 'suggested'.

Vision. In his account of vision, Reid develops an original non-Euclidean geometry, the geometry of visibles, in order to show, against George Berkeley, that the "proper object of vision" has its own metric (Daniels 1989). The local overlapping of visibles with tangibles allows him further to escape Berkeley's rejection of features common to both sight and touch.

Non-Existing Objects. Reid's view about objects of mental acts appears natural in the case of perception, since there *is* an object involved whenever a person is correctly described as 'perceiving something'. But what if the object does not exist, as may be the case in imagining or conceiving? Many had held that one must here postulate some object 'in the mind' – that is, an idea – as a substitute that may allow the act to be about it. Reid, however, insists that objects of thought are not bound to exist. Like Alexius Meinong, he criticizes the prejudice "that, in all the operations of understanding, there must be an object of thought, which really exists while we think of it" (*Essays on the Intellectual Powers of Man* 368b). Reid maintains that, in the case of my imagining a centaur:

> This one object which I conceive, is not the image of an animal – it is an animal. The thing I conceive is a body of a certain figure and colour, having life and spontaneous motion [while the idea] has neither body, nor colour, nor life, nor spontaneous motion (ibid. 373a–b).

He thus gives an illustration of the later Meinongian "principle of independence of being and so-being" according to which predicates can be truly asserted of an object independently of its existence.

Generality. The object of a conception may be general, according to Reid, even if the act of conception is always particular:

> Suppose I conceive a triangle. The act of my understanding in conceiving it is an individual act, and has real existence; but the thing conceived is general.

As a merely general thing, it does not exist, Reid holds, and "it cannot exist without other attributes, which are not included in the definition [of the triangle]" (ibid. 394a). In the case of our conceiving a non-existing item, the item possesses only the characteristics that are specified by the relevant definition. Items serve as universals in lacking the characteristics appropriate to any existing thing, first of all location in time and space. Generality is thus restricted to non-existing objects of conception. Qualities treated as existing items are as particular as the things they are the qualities of (ibid. 395a).

Belief. Reid rejects Lockean and Humean theories of belief and judgement, both of which derive from the 'theory of ideas'. Judgement, though it implies the conception of a proposition (and thus proves to be one of the many cases of one-sided inseparability Reid is interested in), is an original act of the mind (*Inquiry into the Human Mind* 107a–108a, *Essays on the Intellectual Powers of Man* 413af.). Reid often speaks of affirmation and denial as opposite attitudes to one and the same proposition. In this, he shows himself an heir of the Cartesian doctrine of judgement. He then reconstructs a theory of belief formation that remains independent of the main tenets of the 'theory of ideas'. His theory includes the description of a large range of 'first principles' that account for the whole extension of common-sense beliefs (*Essays on the Intellectual Powers of Man* 434af.); for example, "That those things do really exist which we distinctly perceive by our senses, and are what we perceive them to be", which is one of the "first principles of contingent truths", while mathematical axioms belong to the "first principles of necessary truths".

Persons and Their Identity. Reid also disagrees with a number of empiricist doctrines concerning persons and their identity. He

objects to Hume's view of the self as amounting to nothing more than a bundle of perceptions, holding that the existence of a subject or self is presupposed by each perception. He objects to John Locke's view, that the identity of a person is determined by an identity of consciousness and memory, that it confuses personal identity with the evidence one has for it. Further, he remarks that if Locke's account and the transitivity of identity are admitted, then lapses of memory would imply that one was both identical and not identical with oneself in the past (*Essays on the Intellectual Powers of Man* 350a–353a).

Agency. Reid advocates a notion of agency according to which agents have the power to act as efficient causes (*Essays on the Active Powers of Man*, 1788, 527bf.). They thereby act freely, i.e. have power over the determinations of their will. In Reid's view, an active power controls all that is necessary to the production of the relevant effect: a change in thought, a particular will, etc. (ibid. 603b). He therefore rejects determinism, which implies that necessary conditions of these effects remain outside of the active power's scope.

Social Acts. Reid considers acts that are not 'solitary' as perceiving or conceiving are, but 'social' in their very nature: questioning, commanding, giving testimony (*Essays on the Intellectual Powers of Man* 244a–5b). Such acts involve the use of language and are necessarily addressed to persons other than the speaker. He attacks Hume's account of promising on grounds similar to those of the later speech act theorists (*Essays on the Active Powers of Man* 663a–70b).

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Reinach, Adolf

Adolf Reinach was born in Mainz in 1883 and studied in Munich from 1901 onward, where he imbibed phenomenology as propagated by his fellow student Johannes Daubert. Reinach also espoused Daubert's ontological realism and shared his interest in logic and language. Taking his habilitation under Edmund Husserl in Göttingen in 1909 (with a now lost manuscript, "Wesen und Systematik des Urteils"), Reinach became the mentor and teacher of the Göttingen phenomenologists (including Hedwig Conrad-Martius, Dietrich von Hildebrand, Roman Ingarden, Alexandre Koyré, Hans Lipps, and Edith Stein). In 1914, Reinach joined the army; he was killed in battle in 1917.

Reinach sets out from the view of the early Husserl as expressed in the *Logical Investigations*, according to which all uses of language express meaning-bestowing intentional acts. Perceptions or presentations are expressible by names referring to objects; the act of apprehension, however (in the sense of a seeing or hearing that), constitutes those objects into special forms called *states of affairs* or *Sachverhalte*. This act of apprehension generates also on the subject side a belief or a conviction that this state of affairs is the case. Reinach's paper "On the theory of the negative judgement" of 1911 contains both a detailed ontology of states of affairs and a thorough account of the relations between conviction and assertion, particularly as concerns the issue of negative conviction or disbelief and of negative assertion and the polemical negative judgement. Belief or conviction can, Reinach points out, be expressed in an explicit assertive act. Conviction and assertion differ, however, in that the conviction is a lasting unitary state admitting of varying degrees of certainty, where the assertion depending on it is a punctual act or event with a propositional structure tied to language. Yet the correlate they both intend is an identical state of affairs.

The world of existing objects is positive throughout; yet both positive and negative states of affairs subsist or are the case. Objects come and go, but states of affairs, according to Reinach, are atemporal.

Reinach here embraces thereby what might be seen as a Platonistic ontology of states of affairs. States of affairs are also such as to possess modalities. There are no probable things, but states of affairs may be the probable, possible, or necessary. Finally, states of affairs alone stand in the relation of ground and consequent. No object follows from another object, but from its existence or non-existence certain things may be derived. In the same way a proposition's content depends on what is the case, the laws of logic therefore depend on the formal links connecting states of affairs.

To perception, conviction etc., their linguistic expression is accidental. To an assertion, in contrast, its expression is essential, since it is the very expression of an internal conviction. Thus one may utter an assertion in speaking to oneself in soliloquy. Other uses of language, however, necessarily must be addressed to other persons. Reinach was the first to discover the peculiarities of those language-dependent actions, nowadays called speech acts (he himself termed them social acts). Assertions are built upon convictions, and social acts, too, presuppose some mental state (a question presupposes an uncertainty, a command, a will to see something done). However, they do not express, register, or report it, and therefore cannot be true or wrong. Moreover, they are performed by the very utterance (of a question, of a command or promise). This is shown by the fact that

1. social acts are invariably performed in the first person singular present, and
2. they can be amplified with a self-referring 'hereby' ('I hereby promise you . . .').

Social acts give rise to certain objective formations (from a promise there springs of necessity a claim and obligation). These, in contrast to states of affairs, are temporal (when the promise is fulfilled, the obligation ceases to exist); yet, in contrast to things such formations are ideal. Reinach lists also various modifications of the social act, including what today are called infelicities. Thus a social act may be performed by proxy (a promise may be given in the name of another person), its mental basis may be lacking (insincere promise), it may not be taken up or registered by the person it addresses (the promise is refused or is not caught), it may be conditional ('In case this or that will happen, I promise you . . .'), etc.

These ideas are expounded by Reinach in his monograph "The a priori foundations of civil law", published in Husserl's *Jahrbuch* in 1913. As the title indicates, Reinach sketches here a new view of the status of legal utterances, falling between the traditional natural law theory and more modern theories of the positive law and in some respects finding room for the insights underlying both. The determinations of positive law, especially, are accounted for by Reinach as speech acts of a hitherto unrecognized sort.

Reinach made important contributions also to the history of philosophy, dealing particularly with Kant's views on David Hume, and showing especially how Kant misinterpreted Hume's views on causality and necessity. Reinach's thinking in this respect led to a new, non-Kantian understanding of the *a priori*.

Reinach's thinking on the *a priori* can be summarized as follows. From Kant to John Searle there has held sway amongst philosophers quite generally a tendency to seek to view the *a priori* as something logical or epistemological. For Reinach, in contrast, as also for Husserl and Max Scheler (1874–1928), there are *a priori* structures *in re*, structures which exist as items of worldly furniture and are capable of being investigated as such, in *a priori* disciplines modelled on Euclidean geometry. Hence the world as it is in itself, according to Reinach, manifests dimensions of intrinsic intelligibility and our *a priori* knowledge is as it were a secondary matter, triggered by our familiarity with the corresponding intelligible structures in the world.

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KARL SCHUHMANN

Reism

Reism is a view according to which the ontological inventory of the world exclusively consists of things. The most comprehensive system of reistic ontology was proposed by Tadeusz Kotarbiński (1886–1981), a modern Polish philosopher. Rudiments of reism may be also found in some ideas of Leibniz, Franz Brentano and the so-called 'young Brentanists' A. Kastil and O. Kraus; for history of reism, see Kotarbiński 1976 and B. Smith 1990. All proponents of reism agree that reality is made up exclusively of *concreta* (things). However, there are considerable differences among reists. For Leibniz, things are spiritual in their essence. Brentano and the young Brentanists represented a dualistic reism: the world consists of souls and *corpora*. Yet, Kotarbiński's view, developed by him independently of earlier reistic doctrines, is that things are extended and resistant objects: this is materialistic reism, sometimes termed by Kotarbiński as 'pansomatism'. He also used the term 'concretism' in order to stress the nominalism involved in reism. Perhaps reism as something common to Leibniz, Brentano, young Brentanists, and Kotarbiński may be characterized as a formal ontological theory that all *realia* are individual objects. Now, particular versions of reism differ with respect to their metaphysical content which may be consistent with spiritualism, dualism, or materialism. This characterization uses the distinction formal ontology/metaphysics related to that developed in phenomenology. In that which follows, I shall concentrate on Kotarbiński's reism; for further information see Kotarbiński 1929 and Woleński 1989 and 1990.

Kotarbiński's reism has two dimensions: ontological and semantic. The first was described as follows in terms of a general characterization of reism: ontological reism states that things (regarded as extended and resistant *corpora*) and only things exist. Reism is also a view concerning language. These two aspects of reism were, in the first stage of Kotarbiński's philosophy, not sharply distinguished but later reism became mainly a semantic view.

Kotarbiński used in his considerations a table of ontological categories proposed by Wilhelm Wundt (1832–1920) and consisting of four items: things, states of affairs, relations, and properties. The basic thesis of ontological reism may be formulated in two sentences:

(R1) Any object is a thing.
(R2) No object is a state of affairs or relation or property.

A crucial distinction of semantic reism is that of genuine and apparent names (onomatoids). The former are names of concrete objects – things in Kotarbiński's sense – but the latter have alleged reference to abstract objects, alleged since reism denies the existence of *abstracta*. Although onomatoids have no denotation, they are not empty but genuine names which occur in meaningful sentences. Rather, sentences with apparent names are devoid of literal meaning. The difference may be illustrated by 'a square circle is round', a false (meaningful) sentence with a genuine empty name 'square circle'; and 'properties are abstract objects', a meaningless pseudo-sentence with the onomatoids 'property' and 'abstract objects'. Kotarbiński points out that this analysis assumes a so-called fundamental meaning of the *copula* 'is'. Roughly speaking, the fundamental meaning of 'is' is defined by Stanislaw Leśniewski's ontology (calculus of names). However, it should be noted that reistic semantics does not follow from Leśniewski's logic. The usefulness of this logic for reism consists in that sentences of the form '*A* is *B*' are interpreted so that the referent of *A* is also denoted by *B*. This interpretation enables us to regard common nouns as genuine names of individual objects.

Sentences with apparent names may be used but, according to reism, this is an abbreviated way of speaking, admissible only if they can be replaced by sentences in which only genuine names and logical constants

occur; for instance, the sentence 'Whiteness is a property of snow' may be expanded into 'Snow is white'.

Kotarbiński stressed that reism is a quite natural interpretation of everyday language. Moreover, everyday experience consists in a contact with bodies in the reistic sense; assertions of the existence of abstract objects are hypostases (like Francis Bacon's *idola fori*) created by abuses of languages with onomatoids and a contamination by metaphysics. Reism was developed by Kotarbiński as an anti-speculative programme. He expected that therapy via reistic semantics was a good device for campaigning against speculative metaphysics.

Reism encounters various difficulties. Its critics (see papers in Woleński 1990) stress that (R1) and (R2) are not reistic assertions at all. Other difficulties concern a reistic interpretation of mathematics (especially set theory), physics (especially the reality of fields), semantics (especially its intensional parts), and humanities (especially all concepts in which values are involved). Doubtless, these are very serious problems. On the other hand, reism is more successful than other nominalisms are, possibly because of its connections with Leśniewski's logic.

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JAN WOLEŃSKI

Relation I: History

There are some ontological approaches to the problem of relations in the pre-Socratics and in Plato (e.g. Plato's exposition of a secret pre-Socratic doctrine in the *Theaetetus*, 15–60). Aristotle is the first to discuss the question of relations as significant expressions in his treatment of the problem of the category 'relative' (πρός τι; *Cat.* Chapter 7). The very name 'relative' tends to define the problem as being not one of relatedness, but of related beings. 'Relative' is thus a property of things: e.g. it is the master or the slave who is relative, not the relation between mastery and slavery.

Relations are expressed in various linguistic forms and their analysis must therefore be distinguished from the analysis of grammatical expressions. Relatives can occur in the following linguistic forms: as relative predicates (e.g. is bigger than); as one-place relative predicates (being big – in relation to Harry); as transitive verbs (e.g. to see someone), or as in the so-called oblique case (e.g. is a teacher of Harry).

The first definition in the *Categories* (6a36–37) seems to refer to grammatical possibilities. Relative expressions need a supplement in another case: 'We call a thing relative, when it is said to be such as it is from its being *of* some other thing or, if not, from its being related to something in some other way'. But this poses the problem of how to distinguish relatives from substances and on the other hand relatives from accidents in the remaining categories (e.g. quality, posture, state, etc.). Is there no substance which could be called a relative? Is for example a 'hand' a relative because it is always the hand *of* someone? What is the difference between relatives and other accidents, if the quality 'knowledge' is named relative as well, e.g. in the sentence 'knowledge is thus of the knowable'? At the end of this chapter, Aristotle tries to solve these problems by introducing a stricter definition: "those things are true relatives only, whose very existence consists in their being in some way or other related to some other object" (8a32–34).

But what is such a being-related? What does a relative expression denote, aside from its *relata*? This problem touches on a vehemently disputed ontological problem, because the essence of a relation seems to differ from that of its *relata* which are – on the

Aristotelian approach – substances. The relation differs also from the remaining accidents or properties, for a relation is neither an ultimate independent being nor an accident of just *one* substance. Relations do not signify properties of an individual, but the connections between individuals. Aristotle and the Aristotelian tradition in the Middle Ages understand relations as accidents, founded in substances that are *relata* or *fundamenta relationis*. Whether a relation is distinguished from its *relata* by reason (*rationis*), in reality (*realiter*) – as an entity in its own right – or on the basis of form (*formaliter*) is the classical question of the nature and ontological status of relations.

The Stoics did not admit a real existence of relations but only an existence in thought. This view was transmitted by Sextus Empiricus (*c.* 150–*c.* 225), Plotinus (*c.* 205–*c.* 270), and Simplicius (fl. *c.* 530) and reinforced by an argument of a key text in Aristotle's *Physics* (225b11–13; cf. also 1088a29–35):

> nor is there motion in respect of relatives: for it may happen that when one correlative changes, the other can truly be said not to change at all, so that in these cases the motion is accidental.

So *x* can be or cease to be related to *y* without being internally changed, and therefore, as Aristotle concludes, the relation is least of all accidents a kind of real object and existing thing (1088a30), whereas the Stoic conclusion is that relation exists only in thought.

In the Middle Ages the following two alternatives were mainly discussed:

1. *Relatio rationis* is an *ens rationis*, a being produced by reason, illustrated by the relation of subject and predicate.
2. Real predicamental relations (so-called *relationes reales*), instanced by the relation of father and son. These fulfil in the philosophy of John Duns Scotus the following criteria: they have real objects as their *relata*, and they are really different from these (*Ord.* I, d.3 q.un; *Vat.* VI, 204). In agreement with Aristotle (1088a29–30.) Thomas Aquinas calls the reality of such real predicamental relations an *ens minimum* (*Sent.* I. d.26, q.2 ar.2, ad 2). So the relation of similitude, for example, is founded not in a substance, but in accidents, namely in qualities (e.g. white), the relation 'greater than' in quantities (e.g. great).

Duns Scotus distinguishes also transcendental relations, e.g. the relation of diversity, which are not really, but formally different from their *relata*: every entity differs from every other.

As a consequence of his nominalism, which admits only singular substances and singular qualities, William Ockham denies any reality to the relation beyond that of the individual *relata*. A relative term is a connotative name and signifies only the *relata* – just as the relation is nothing beyond the *relata*. Relation is for him many things (*multae res*; *Sent.* I, d.30, q.5). If the relation were something beyond the *relata*, he argues, then the movement of a finger through space would change the reality of the finger at every moment. Relation can be predicated of substance without a real change in the substance. For Ockham a relation cannot be a real accident, because it would have to be founded in two distinct subjects. Whereas for Ockham real relation is *multae res* only, Peter Aureoli (died 1322) takes up the Stoic thesis that relations have an existence in reason only.

In early modern philosophy there is a strong tendency finally to reduce all categories to substance and relation. In the New Science of the 17th century, and especially in the work of René Descartes and Galileo, qualities are reduced to quantity (extension), which makes possible a natural philosophy of a mathematical sort. Leibniz reduces quantity to relation and understands mathematics as a theory of relations, so that the Aristotelian division of things into substance and accident becomes a division into substance and relation. The accidents of bodies are defined in terms of the relations among bodies, which is to say in terms of action and reaction and of the connections in a system. Nature is thus understood as a system of relations.

On the other hand the understanding of relation as a name (term) or as an idea

becomes increasingly more important. This trend appears already in Ockham's division of all terms into absolute terms (substance, quality) and connotative (i.e. relative) terms (all other categories). The latter does not stand for relative entities, but for another mode of signifying individual substances or qualities. Relations in modern philosophy are not real predicamental accidents; they are relations of thought. There are only individual substances. The relation of one substance to another exists only in the intellect of the observer. Thus the Cartesian Johannes Clauberg (1622–65) thinks that every relation is nothing but a comparative act of the intellect (*Op. omnia philos.*, I, 318). Relation becomes an act of comparing two or more things.

If, however, we suppose that relation, i.e. the uniting of a plurality of individual things into a relative concept, is a mental act, the question arises how statements about relations can claim objective validity. For their *fundamentum* is not in things but in the mind. The answer of Kant's transcendental philosophy is that even objectivity is constituted by the uniting activity of the understanding. In this tradition the relations that are determined by the laws of nature are constitutive for the nature of things, which is now a function, a lawful connection or law – as for example in neo-Kantianism, in Ernst Cassirer or in A. N. Whitehead. Things are no longer understood in terms of substance and accidents, but in terms of relations, structures, or laws. In post-Kantian philosophy, therefore, a fundamental change in the nature of relation occurs: things, the objects, are defined by relations, not by an οὐσία (substance), and Nature as a whole is thought of as a system of relations. This change could be characterized as a change from an ontology of substances to an ontology of functions or relations. Relation is furthermore not considered from the point of view of its *relata* but in its own right, as relatedness.

The *logic* of relations reflects this change in ontological theory. In modern logic relations have a logical structure different from that of properties, so that from this point of view classical logic could not have adequately treated relations since they interpreted predication always in the light of the ontological structure of substance and accident: an accident is said of a substance. Because relation is an accident, its logical structure is the same as that of properties. Although already Galen (*c.* 130–200) investigated relational arguments (e.g. Sophroniscos is the father of Socrates, therefore Socrates is the son of Sophroniscos; *Introduction to Logic*, XVI), as did Joachim Jungius and Leibniz, the adherents of classical logic were not able fully to describe the properties of such arguments.

Augustus De Morgan (1806–71), Charles S. Peirce, Ernst Schröder (1841–1902), and Gottlob Frege were the first to succeed in this. The most complete investigation was that of Bertrand Russell and Whitehead in the *Principa Mathematica*. Modern work on the logic of relations, today a part of the logic of predicates, played an important part in helping to replace the old subject-predicate logic (with its substance–accident scheme) with the modern predicate logic (with its argument–function scheme). In modern logic, relations are distinguished from properties (qualities, characters, characteristics; see Rudolf Carnap, *Meaning and Necessity*, 1947). A property-term is an unsaturated expression making a meaningful proposition by substitution of an individual constant in the argument place. A relation-term is a two- or many-place unsaturated expression; thus predicates of n arguments are called n-ary relations. In logic relation-terms are thus two- or more-place unsaturated or incomplete expressions predicated of subjects or of *relata*. Anthony Kenny distinguishes n-adic predicates from relational expressions in the strict sense: it appears to be of the essence of a relational expression in the strict sense that its polyadicity should be stable. '. . . bigger than . . .' is always a 2-adic predicate. Actions however are n-adic predicates having a variable polyadicity according to the circumstances: in the sentence 'Brutus killed Cesar', the predicate 'killed' is 2-adic. But in completing the same sentence with: *with a knife, in the bathroom*, etc., the same verb can be used as a 3- or 4-adic predicate and therefore is not a relational expression in the strict sense.

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PETER SCHULTHESS

Relation
II: Mathematical Relations

With the development of set theory and of the mathematics of structure there arose a concept of relation which is important not only for the foundations and the architecture of mathematics, but also for a precise and adequate explication of traditional metaphysical relation-talk.

1. Let us suppose that we have some set-theoretic language in which the functor 'the ordered pair of..and..' – in short: '[.,..]' – and the predicator '..is an ordered pair' have been defined in one of the known ways with recourse to unit-sets and pair-sets, so that the order-lemma 'If $[x,y] = [u,w]$, then $x = u$ and $y = w$' holds. The first component of $[x,y] = x$, the second component $= y$. It is then possible to define *relations* as sets of ordered pairs, and whatever holds for sets in general is true of relations in particular. The phrase 'the ordered pair of x and y is an element of R' (or '$[x,y] \in R$') shall be replaced in what follows by expressions such as 'x stands in R to y', 'R holds between x and y' etc. – or 'xRy' for short. There is a special criterion of identity for relations: $R = S$ iff (xRy iff xSy). Subsets of relations are relations, too. Because of this, the intersection of a relation R with an arbitrary set M preserves the relational character of R. Similarly if one subtracts some arbitrary set M from a relation R, then a relation also results, whereas the union of two sets is a relation only if the two unified sets are relations. Furthermore it is possible to describe the *relational part* of an arbitrary set M as the set of all ordered pairs which are elements of M.

2. If there is a z that stands to y in R, then y is a *domain-term* of R; and if there is a z to which y stands in R, then y is a *range-term* of R. An entity y is a *term* or *relatum* of R, if y is a domain-term or a range-term of R. The set of domain-terms is the *domain*, the set of range-terms the *range* of R, and the union of the two is the *field* of R. The elements of a relation – by definition ordered pairs – have to be separated from its terms. The tradition uses '*subiectum relationis*', '*fundamentum relationis*', '*terminus a quo*' for 'range-term', and '*terminus relationis*', '*terminus ad quem*' for 'domain-term'. The *Cartesian product* C of any sets U, M is defined as the class of all ordered pairs whose first component is an element of U and whose second component is an element of M. C, then, is a relation, with U as range, M as domain and the union of U and M as field; conversely every relation can be seen as a subset of the Cartesian product of its range and domain.

3. The *converse* of a set R is the class of all ordered pairs $[y,x]$ for which xRy. The converse of an arbitrary set is always a relation. The converse of the converse of a relation R is identical with R. (The converse-operation thereby makes transparent the nature of the so-called '*Reflexionsbegriffe*'.) The *relative product* of R and S is the set of all ordered pairs $[u,w]$ such that there is an x with uRx and xSw; thus relative products are always relations and the operation of taking relative products is not commutative, but associative. The *image* of the set M under R is the set of all y which stand in R to at least one element x of M. Thus the R-image of $\{x\}$ is the class of all y, which stand in R to x. If a set M is a subset of a set N, then the R-image of M is a subset of the R-image of N. Further, if R is a subset of S, then the R-image of M is a subset of the S-image of M. A relation R can be *range-restricted* to a set M, resulting in the set of all ordered pairs of R whose first component is an element of M. The notion of *domain-restricted* and *field-restricted* relations can be similarly defined. Restricted sets are always subsets of the original sets.

4. A relation R is *left single-valued* if xRy and zRy imply $x = z$. The property of being *right single-valued* is defined analogously. Relations which are both left-and right single-valued are *one-to-one relations*. The converse of a left single-valued set is right single-valued and conversely. *Functions*, now, can be identified as left single-valued (alternatively: right single-valued) relations. If f is left single-valued and x is in the domain of f, then the *value* of f *for* x is y or $f(x) = y$ iff yfx. Arbitrary functions f,g are identical if their domains are identical and if it is true for all f-arguments x that $f(x) = g(x)$. f is a *function on* A iff f is a function, whose domain is a set including A. f is a *mapping from* A *into* B iff f is a function on A, so that the f-image of A is a subset of B. f is an *injection from* A *into* B iff f is the right single-valued mapping from A into B. f is a *surjection from* A *into* B iff f is a mapping from A into B so that B is a subset of the f-image of A. f is a *bijection from* a *into* B iff f is both surjection and injection from A into B.

5. The structural properties of relations, i.e. the properties which are invariant with regard to isomorphism, are of particular interest in respect of the theory of order and equivalence. R is *isomorphic* to S iff there is a bijection f from the field of R into the field of S, so that for all R-terms x,y there holds: xRy iff $[f(x),f(y)]\epsilon S$. There are four kinds of structural properties: (i) R is *totally reflexive* iff each entity stands to itself in R. R is *reflexive* iff each R-term stands to itself in R. R is *irreflexive* iff there is no entity which stands to itself in R. (ii) R is *symmetric* iff xRy implies yRx. R *is asymmetric* iff xRy excludes yRx. R is *antisymmetric* iff xRy and $x \neq y$ together exclude yRx. Asymmetric relations are always antisymmetric. Irreflexive and antisymmetric relations are always asymmetric. If all relations were symmetric, i.e. if the order of the elements were of no importance, then reference to pair-sets would suffice for the definition of relations; the introduction of the notion of ordered pairs would be superfluous. (iii) R is *transitive* iff when xRy and yRz it is also true that xRz. R is *intransitive* iff when xRy and yRz it is not true that xRz. R is *left-comparative* iff when yRz and xRz it is also true that yRx. R is *right-comparative* iff with zRy and zRx it is also true that rRx. (iv) R is *connected* iff for all R-terms x,y: xRy or $x = y$ or yRx. R is *strongly connected* iff for all R-terms: xRy or yRx. For reflexive relations connectedness and strong connectedness coincide. Asymmetric relations are irreflexive; transitive and irreflexive relations are always asymmetric. A relation R is transitive and symmetric iff R is left-comparative and reflexive iff R is right-comparative and reflexive.

Some further structural properties of order can be dealt with as follows: R is *S-reflexive* iff for arbitrary x,y with xSy it also holds that xRy. R is *S-irreflexive* iff when xSy it does not hold that xRy. R is *S-antisymmetric* iff when xRy and not xSy it does not hold that xRy. R is *S-connected* iff for arbitrary R-terms x,y there holds: xSy or xRy or yRx. (If one chooses S so that it is the identity-relation which is restricted on the field of R, the original property of R results.) Finally, R is S-extensional, if it is true for arbitrary x,y,u,w that, if xSu and ySw and xRy, then uRw.

6. Given a theory of the natural numbers, it is possible to define: t is an *n-tuple* (*in* M) iff t is a function, n is a positive natural number and the domain of t is the positive segment, which is restricted to n (and the range of t is a subset of M); n-tuples are finite sets. Each non-empty finite set can be seen as the range of an n-tuple. The 1-tuple of x – in short: $<x>$–is the function, whose single element is the ordered pair $[x,1]$. Analogously: $<x,y> = \{[x,1], [y,2]\}$; $<x,y,z> = \{[x,1], [y,2], [z,3]\}$, etc. An order-lemma holds for 2-tuples – if $<x,y> = <u,w>$, then $x = u$ and $y = w$ – exactly as for ordered pairs. Yet 2-tuples are different from ordered pairs. Given tuples can be concatenated to new tuples.

f is a *finite sequence* (*in* M) iff there is an n, such that f is an n-tuple (in M). f is a *countable infinite sequence* (*in* M) iff f is a function whose domain is identical with the set of positive natural numbers (and whose range is a subset of M). f is a *finite denumeration* (*in* M) iff f is a right single-valued finite sequence (in M). The concept of *infinite denumeration* is defined analogously. B is an *n-adic connexion* (*in* M) iff all B-elements are n-tuples (in M). The i-th *domain* of B is the class of all

u for which there is an n-tuple t of B with i in the domain of t and u the t-value of i. We now define: p is an *n-tuple-pair* iff p is an ordered pair whose second component is an n-tuple. For example $[u,<x>]$ is a 1-tuple-pair, $[u,<x,y,z,w>]$ is a 4-tuple-pair. R is then an *n-adic relation* (*in M*) iff all R-elements are n-tuple-pairs (and the range of R is a subset of M and the domain of R is an n-adic connexion in M). Since n-adic connexions are reducible to n–1-adic relations, they can therefore be treated as relations. f is an *n-adic operation* (*in M*) iff f is an n-adic left single-valued relation (in M).

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GEO SIEGWART

Relation III: Internal Relations

Some philosophers have held that the relations between things are all of them internal, some that all are external, and some that there are relations of each kind. Others have thought that some or all are internal to one term, but not always or perhaps ever to the other. (For simplicity, attention is restricted to two-term relations.)

We can take 'external' as meaning 'not internal', but what does 'internal' mean? Relations seem to have been called 'internal' on three different grounds. Sometimes a thing's 'internal' relations, in the sense of its relations to its parts or of its parts to one another, are contrasted with its 'external' relations to things outside it. This ordinary usage is not prominent in philosophy but its lurking presence sometimes confuses discussion of two more important grounds on which a relation may be called 'internal'.

1. Relations are sometimes called 'internal' because they are 'ideal', in the sense of being relations of contrast, or affinity, or difference of degree, in the inherent characters of things (characters the things possess strictly within their own boundaries either in a spatial or analogous sense). That one apple is rosier in colour than another will be an ideal relation between them. (Also describable as 'ideal' – in a sense more or less different according as to how one thinks things stand to their characters – are the corresponding relations between the characters themselves.) Such relations, *prima facie*, have nothing to do with what may be called in contrast the 'real' relations between things, relations of juxtaposition in a common environment, of causation and perhaps of other types similarly not merely ideal. Most empiricists and realists have allowed that some relations are internal in the sense of being ideal and as thereby contrasting with relations which are external in the sense of being real.

2. However, some philosophers believe that things can stand in real relations to other things which are internal to them in the sense that being in that relation to the other is necessarily bound up with what they are within their own boundaries. A. N. Whitehead and C. Hartshorne believed that the most basic sorts of real relation are internal at one end, external at the other. When an event is individually remembered it is internal to the memory that it registers that particular past event but not internal to the event that it would be so registered; moreover, properly understood the relation between effect and cause is always of this sort.

Absolute idealists have tended to think that all relations, or perhaps that all *real*, relations are internal at both ends. This is associated with the view that at least all *real* relations are what we may call 'holistic' relations. A relation is not holistic merely because it holds between parts of a whole. To be holistic a relation must actually *be* the precise way in which the terms form a whole

together, perhaps with the aid of other things. (Alternatively, perhaps, it may be a species of whole/part relation, but the qualifications this requires would complicate our account unduly.) On the face of it a holistic relation need not be internal to either of its terms. Why should there not be relations which are the way in which the terms combine to form a whole without their inherent natures being so pervaded by that whole that they could not be the same outside it? However, absolute idealists have argued that this is not really possible and that a holistic relation must be internal, namely a matter of the way the terms belong together in, and help to constitute, a larger whole where the nature of the whole, as a whole, so pervades these parts that their being in these relations is reflected in their individual inherent natures. Thus the social relations between people in a group were held to enter into what each was individually.

A thing's ideal relations to other things and its real internal relations to other things have, or would have, in common their close involvement with its inherent nature. But they differ in that the real internal relations would be a partial determinant of its inherent nature, while the ideal relations would merely follow from that inherent nature (though not from it alone, for the other thing would have to exist and possess an appropriate character). Thus the two sorts of internal relation seem to be very different. If A has a real internal relation to B, the existence and character of B is somehow implied by A's inherent character, but this is not implied by any merely ideal relation it may have to it. Moreover, the *prima facie* possibility of a relation which is internal only at one 'end' only holds with those which are real. It is the real internal relations whose existence is seriously controversial (apart perhaps from the special case of relations between whole and part).

Note that the inherent nature in the relevant sense of a continuant is what it is like within its own bounds when it stands in the relation whose type is in question. Discussion becomes hopelessly confused if it is taken for some enduring essence of a continuant which it cannot acquire or lose. Discussion of the whole issue tends to be clearer when the terms of the relation are conceived as events.

We have been describing relations as internal or external with reference to particular terms which they relate rather than merely in the abstract. However, a relation will presumably have the same such status in any instantiation of it, and can be categorized accordingly.

Especially interesting discussions of internal and external relations are to be found in F. H. Bradley, William James, George Santayana, Edmund Husserl, Bertrand Russell, A. N. Whitehead, C. Hartshorne, and Ludwig Wittgenstein; of earlier philosophers the views of Leibniz and David Hume are of most importance. Leibniz thought, in effect, that *all* relations were ideal; Bradley that all were holistic; Russell that all were external; Hume, Santayana, and Wittgenstein that they must be either ideal or external. The other thinkers resist such summary classification. A modern argument for the internality of all relations is that of T. L. S. Sprigge.

One source of confusion is between *de dicto* and *de re* internality. It is sometimes said that the relation between Socrates and Socrates' wife is internal but the relation between Socrates and Xanthippe is external. This is mere trifling, though we can call it *de dicto* (turning on the way the things are referred to) internality and externality if we wish. The serious question is the *de re* one as to how far these two persons, however referred to, have natures intrinsically bound up with being in these relations. This is sometimes dismissed as an idle dispute as to which of a thing's characteristics pertain to its nature. But if, as is best, we relate the issue to a thing's inherent nature, understood as what the thing is within its own bounds at the relevant time, the question whether that nature can point to the way the thing is related to things beyond it in the way in which Hume famously maintained it cannot is a serious and vital one.

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TIMOTHY L. S. SPRIGGE

Relativism

Relativism – a doctrine implying the essential relativity of the type or notion under investigation to some term or frame – stands opposed to absolutism, which admits no need for a relation; consider for example the dispute as regards space, as to whether relation to some framework is required for mere position. Relativism is then relativity *of* so and so with respect *to* such and such; so it is two-way determinable. That is, it involves determination, first, as regards *type*, through topic or subject (e.g. truth – whence semantic relativism; knowledge – whence epistemic relativism; belief – whence doxastic relativism; value or ethics – whence ethical relativism, etc.); and, second, as regards *relativizing term* (e.g. for ethical relativism: individual, society, culture, system). Thus for example ethical relativism takes such forms as subjectivism and cultural relativism as well as ethical conventionalism and situational ethics. Contrary to widespread social scientific opinion, types of relativism exhibit significant independence. In particular, doxastic relativism (for which there is appealing initial evidence through cultural divergences in beliefs) affords in general no guarantee of semantic relativism. Total relativism is relativism across all subjects (in some respect); it is the doctrine that (relatively speaking, of course) there are no absolutes; everything is relative.

Part of the case for relativism derives from the variability of views and positions, none of which seems rationally compulsory, or enforceable by argument over all others. The contemporary drift to relativism, particularly marked now in the philosophy of science, was much stimulated by an exponentiation in information-gathering, especially in recent anthropology and sociology. The results have shattered many former absolute certainties, by revealing the vast extent of cultural variation, and also the arbitrariness and conventionality of the historical consensus-making procedures by which present certainties were reached. However, variability does not on its own establish relativity (since many variations may be wrong or otherwise defective); still less does it establish orthodox undiscriminating relativism, according to which no variation is better than any other (since some variations may be relatively superior).

There are several stock arguments against relativism, which certainly do serious damage to over-ambitious relativisms, including orthodox forms. The most famous of these is the argument, essentially deployed by Plato against Protagoras, that relativism is *self-defeating*, facing the following dilemma. Either relativism is self-refuting, catching itself in its own scope, or it is ineffective. For self-refutation, consider the relativist thesis itself, applied to 'rightness' of some type, which is advanced as right. If it is right, then by the thesis itself nothing is right, including itself; therefore, by *reductio ad absurdum*, it is not right. So the thesis is both right and not right, which is impossible. Sometimes an attempt is made to push the argument further, to absurdity proper (or 'incoherence') along these lines. Adoption of the thesis is said to undermine the very notion of rightness, rendering rightness unintelligible (e.g. it converts rightness into a notion that is not significant, 'relative rightness').

The main argument thus far proceeds on the assumption that relativism is advanced, or defended, as right, i.e. in a way that appeals to apparently non-relativistic features. (It also depends upon, what is less remarked, the assumption that relativism is classically rational, to the extent of accepting certain argumentative principles, such as *reductio* and the classical total embargo on contradictions, principles now contested.) Should that non-relativistic assumption be abandoned and relativism be presented only relativistically, then, according to the other horn of the dilemma, relativism is impotent. No case can be made for relativism against a

non-relativist opposition; to present relativism relativistically is not to defend it (rationally) at all, for, by its own admission, it is not better than its alternatives. Again an attempt is made to press the argument further; relativism gets condemned as absurd, because it is now forced to rely upon 'relative rightness'.

Consider, for a more specific example duly detailed, metaphysical relativism applied to truth and made framework relative. If the thesis of such semantical relativism is stated, in the absolute form, that all truth is framework relative, then the thesis itself so formulated affords a counterexample to the claims made. That is, if the thesis is true, then it is framework relative, contradicting the absolute claim it purports to make. But the argument cannot stop there. For the problem of self-refutation is straightforwardly avoided by making the thesis framework relative, to a given relativist framework. But then, so the criticism continues, the thesis ceases to deliver the apparently devastating attack on absolutism that it appeared to be offering; it appears ineffective against alternatives.

The famous refutation is not, however, decisive; it is rather, as duly detailed investigation reveals, the beginning of a dialectic that has yet to run its full course. First, the additional absurdity charge is easily removed, and rightness (correctness, truth) defined with respect to a relativizing frame, as in standard semantics. (The charge is then made that relativism assumes a non-relativistic framework, both syntactically and semantically. And so on.) Second, levels are infiltrated. Somewhat more plausibly, rightness is distinguished into types, and a type theory deployed. So, for example, a less comprehensive thesis of ethical relativism, asserting that ethical rightness is relative, escapes the more sweeping self-refutation argument deploying rational rightness. But such type theory has its own serious problems. Less plausibly still, relativism, like verificationism, is converted into a rule or higher-order thesis, in another attempt to avoid self-refutation.

Third, and importantly, ineffectiveness is disputed. For one thing, a brazen relativism may just dig in; it does not pretend to compete non-relativistically with absolutism, simply to undermine it. (Indeed, by simply waiting for support for absolutism to die out, relativism may not only exhibit its survival power, but may even come to be generally accepted.) For another, the detailed argument to ineffectiveness characteristically presupposes an equality (or neutrality) thesis, that relativism cannot claim to be any better, or nearer right, than alternatives. But a more discriminating relativism, where complete neutrality does not prevail, need not be so impotent. It can readily allow that some positions (including, from its own standpoint, itself) are better than others, and accordingly can stand.

Granted, however, orthodox relativism is more ambitious and less discriminating. It does assume an equality thesis, such as that any position is as good as any other, that no person's opinion ranks above any other, even (with P. K. Feyerabend) that 'anything goes'. Of course, such relativism itself violates the equality thesis, if seriously advanced; to begin, the thesis itself is supposed correct, better than its repudiation – whence derivative self-refutation.

The other stock arguments, though telling against certain orthodox relativisms, are even less decisive against more discriminating relativism. Several of these arguments march under the banner: *relativism is false to the facts* (assumed non-relative facts, of course). In the supporting arguments, there is appeal to evident non-relative truths, knowledge, and so on, especially truths of elementary mathematics and empirical science. There is appeal to imagined cultural absolutes, such as invariant claims concerning science, health, happiness, and the family. But relativism can admit *some* invariants, e.g. those concerning framework structure (as illustrated by relativity theory in physics). Among the facts called upon in support are those of *serious disagreement* between positions, which relativism is supposed to be unable to account for satisfactorily: especially contradiction, incompatibility, etc. But serious disagreement can be explained in relativistic ways, for instance through limited common ground, overlapping frameworks, and so on. A related group of arguments is to the effect that

relativism is unnecessary, for example to account for the facts upon which it is based but to which it is, by its own lights, not entitled. Thus, for instance, such apparently relative general maxims as 'When in Rome do as the Romans do' are said not be relative but really to encapsulate a universal principle applicable to any similar place. So it is with principles that what is right is whatever is actually commended wherever one happens to be. But plainly this idea, that relativism wrongly formulates non-relative themes concerning relations, succeeds only in certain special cases. It does no damage to a more discriminating relativism.

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Relativity Theories

Metaphysical theories of the relativity of motion (such as Leibniz's or Mach's) require that motion be a symmetrical relation among objects, needing no reference to space. If we could define positions simply as relations of distance and angle among objects, and define motion simply as change of position, the theory would be analytic. Then we could choose any object, quite arbitrarily, to fix a frame of reference, i.e. a scheme for identifying the same place at different times. However, no theory of physics clearly conforms to this metaphysical ideal.

Sir Isaac Newton followed Galileo in arguing that mechanics allowed no observable distinction between rest and uniform motion. Nevertheless, Newton said that real motion was motion through absolute space, and motion relative to another body merely apparent motion; it fell to later physicists to claim that there could be no physical basis, observable or otherwise, for preferring one inertial frame of reference to any other. (A frame relative to which the first law of motion holds is called inertial.) But only inertial frames of reference could properly be used in mechanics. So only objects at rest in these frames could be regarded as properly at rest.

James Clerk Maxwell's (1831–79) equations for electromagnetism imply that the speed at which influences, especially light, move in an electromagnetic ether is constant. Thus this speed appears to be absolute because the ether is a universally pervasive medium for light. This idea offered an experimental test for whether any inertial frame is at rest or in motion in the ether. Notoriously, the tests gave no result, though sensitive enough to reveal one.

The Theory of Special Relativity. Albert Einstein's (1879–1955) Theory of Special Relativity of 1905 recasts Maxwell's equations not as characterizing an absolute ether but as invariant under transformation among inertial frames. The ether is replaced by an electromagnetic field, the same for every inertial frame, which affords no basis for preferring any of these special frames to any other. That aspect of the theory was conservative, needing only slight changes in the laws of mechanics. However, the range of properties of things which vary under transformation among frames is much increased, thus greatly changing the concepts of space and time for the first time in the history of physics. Two spatially separated events are simultaneous only relative to a frame; a clock has some rate, a body has its spatial dimensions, mass and so on only relative to a frame. The theory implied the radical consequence that if an accurate clock were moved fast enough round a closed path, relative to some inertial frame, it would measure less time taken by the journey than would a clock which remained at rest in the inertial frame. This surprising result is called the clock or twin paradox. It is not a contradictory result of the theory, despite its still being debated as if it were.

Special relativity allows us to use only inertial frames. This leaves the metaphysical question of relative motion unclear. Though it allows no absolute rest frame, the theory

does yield an absolute motion, since light is at rest in no frame and has the same speed relative to all. Also, the so-called law of addition of velocities (directed speeds) at least hints at a distinction between velocity (as relating an object to a frame) and the time rate of change of distance and angle among bodies (in a frame), whereas metaphysical relativity has generally taken for granted that the concepts are the same.

Einstein's highly operationalist account of simultaneity made his theory look subjectivist, observer dependent, and essentially epistemological; this has misled debate on its structure. The view arose that one was free not only to choose a frame of reference, but also to define simultaneity, conventionally, within it. Though the view is not flatly mistaken, it is essentially confused and readily leads to misunderstandings, such as that there is no objective size, shape, or mass which objects have when they move in an inertial frame, but that we choose to describe them as if they had such properties objectively according to a convention about the matter.

Space-time and Relativity. In 1908, Hermann Minkowski (1864–1909) offered a new interpretation of the theory according to which space and time were to be understood as separate dimensions of a four-dimensional space-time, in which the uniform relative motion of one inertial particle to another is represented by an angle between their corresponding (straight) four-dimensional world lines and in which accelerated motion is represented by curved world lines. The basic structure of Minkowski space-time is the light cone (or null cone). This defines, at each point, the trajectories of all light signals. It thereby separates temporal 'directions' (within the cone) from spatial ones (outside it). It can be used to define the topology of space-time and thus is fundamental to it. A space-time treatment of special relativity has the great advantage of representing the world independently of the standpoint of any reference frame. The frame-relative properties of three-dimensional things are absorbed into invariant properties of four-dimensional things; all clocks measure the same intervals along their respective world lines and the puzzle of the clock paradox is merely a difference between the intervals along straight as against curved world lines joining two points in space-time. The metaphysically puzzling relativity of properties to frames is the natural product of the inclination of one frame to another. Thus it is quite like the way coordinate quantities vary as one describes the same figure, in ordinary three-dimensional space, from the viewpoint of one coordinate system and then another, rotated relative to the first. Thus the Minkowski representation identifies real quantities in a four-dimensional world with properties invariant under frame transformations and removes at a stroke the puzzling appearance of subjectivity and observer dependence in the original formulation of the theory.

The (double) light cone structure at a given space-time point distinguishes events in the upper lobe of the cone as absolutely later than events in the lower lobe; it does nothing to order events outside the cone, relative to the given point. Thus space-time yields no one (hyper)surface of simultaneous events which might be seen as a metaphysical present, partitioning space-time into a global past, present, and future. If this is so, it deals a fatal blow to the metaphysical idea of the flow of an ontically distinguished time, the present, through all events, moving towards the future and leaving past events somehow in its wake.

The Theory of General Relativity. Special relativity is inconsistent with Newton's theory of gravity, for the latter requires gravity to act instantaneously across the space separating mutually attracting bodies, whereas Einstein's theory requires all such influences to be propagated at speeds no greater than that of light. The Theory of General Relativity is best understood as resolving this inconsistency rather than as lifting the special theory's restriction to inertial frames. General relativity is essentially a theory about space-time.

General relativity casts gravity as a curvature of space-time, rather than a force acting continuously in time across space. The space-time of special relativity is quite like Euclidean geometry in structure, and described as flat. This analogy is abandoned in the general

theory in favour of a curvature of space-time which varies from point to point, so as to be equal to the density of mass energy as defined at the points. The curvature and matter-density equality can both be expressed as a tensor equation. The world line of a force-free particle lies on a geodesic ('straightest' line) of this variably curved space-time, so that, when this is projected down in to the motion of an object in the space of an appropriate reference frame, the motion is accelerated. It is important to grasp that it is the variable curvature of space-time, rather than that of the space of any reference frame, which explains gravity.

Though the relativity theories reject an absolute space, they do appear to commit us to the existence of space-time as an entity of our ontology. This seems especially clear in the case of general relativity, where the distribution of matter and the curvature of space-time place constraints each on the other, though the issue is still the subject of a vigorous and complex debate.

It is no simple matter whether the theory does permit a general relativity of motion in the metaphysical sense some philosophers have long wanted. That depends on the particular detailed structure which space-time actually has, which is fixed by initial and boundary conditions; it does not depend on the structure of general relativity itself. In flat Minkowski space-time, curved world lines do not correspond in a suitable way to frames of reference, nor does an 'accelerating' particle give a unique way of specifying the time-like curves of a coordinate system for space-time. In curved space-times there may be structures which prefer some reference frame uniquely, even though, in other possible space-times, no frame is preferred. It is difficult to discuss the matter further without looking at cases in detail.

Current metaphysical and ontological questions to which relativity theories give rise thus concern such issues as whether space-time is to be understood as an entity in our ontology or whether it may be reducible to causal relations among events. But there are questions about the existence of structures within the entity, which are also debated, as to how the metric is defined, and how the direction of time is characterized.

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Relevant Logics

Relevant logics are both philosophically and mathematically motivated: but in both cases, a prime objective is to avoid paradoxes or incoherence, of one sort or another, a feat accomplished through restored or improved connections, especially relevant connection in implicational and inferential linkages. Relevant implications, the focus of most research, are those whose components (A and B in implication $A \rightarrow B$) are relevant to one another, i.e. have enough to do with one another. Broadly relevant, or *sociative* logics assert none but relevant implications; all implicational theses of such logics are relevant implications. Under a technical explication (of weak relevance), relevant implications and logics are explained in the following way: a logic or logical system is relevant if its propositional part contains no theorems of the form $A \rightarrow B$ where A and B fail to share a parameter. So any system which includes or validates paradoxes of implication – such as that contradictions imply everything and anything implies what is necessary (e.g. in standard symbols of the literature):

$$A \,\&\, {\sim}A \rightarrow B,\ B \rightarrow .\ C \vee {\sim}C,\ A \,\&\, {\sim}A \rightarrow .\ C \,\&\, {\sim}\, C, \text{ etc.}$$

is irrelevant. Mainstream logics, such as classical and intuitionistic systems, are irrelevant.

There are as many types of sociative logics as there are different ways of busting the paradoxes of implication, more exactly of invalidating the stock arguments that lead to irrelevant implications. The main types are these:

1. *relevant* logics, which qualify the principles of Antilogism (e.g. $A \,\&\, B \to C \to .\, A \,\&\, \sim C \to \sim B$) and Disjunctive Syllogism (e.g. $A \,\&\, (\sim A \vee B) \to B$);
2. conceptive or *containment* logics, which limit Addition (e.g. $A \to .\, A \vee B$);
3. *connexive* logics, which restrict Simplification (e.g. $A \,\&\, B \to A$) as well as Addition;
4. *non-transitive* logics, which limit Transitivity (e.g. at least the rule, $A \to B$, $B \to C / A \to C$); and
5. *non-ponible* logics, which restrict *Modus Ponens* (i.e. A, $A \to B / B$).

Logics of these overlapping types may well not be subsystems of classical (i.e. Boolean) logic; all types admit of non-classical extensions, and some are characteristically classically incompatible, such as connexive logic which normally includes Aristotle's thesis: $\sim(A \to \sim A)$, no statement implies its own negation.

All these types of sociative logics have historical roots, most reaching back at least to medieval times. For example, semantical reasons for the serious qualification of Disjunctive Syllogism were anticipated in the 15th century by the Cologne School and Domingo de Soto; for they realized that where both A and $\sim A$ hold (as in non-trivial inconsistent theories and many kinds of intensional situations), A does not exclude $\sim A$, A's negation, so B's holding is in no way guaranteed. Generally, however, the historical connections were rediscovered later, after contemporary investigations had begun. In particular, technical studies of the best known of these sociative types, relevant logics proper, were well advanced before it was realized that some of the ideas (e.g. that relevant implication explicated genuine deducibility) were not quite so new, and that popular arguments against the theory appealing to the logical tradition could be matched by rival traditional arguments from dissenting schools. But certain recently neglected features of logical tradition – notably the requirements of preservation of *relevance* and *necessity* in an implication – were early seized upon by Anderson and Belnap (1975), who made these requirements central to their elaborations of entailment, as encapsulated in the system E (of 'entailment'). To them we owe both the title 'relevance logic' and the main systems of relevance logics, a subclass of properly relevant logics in the vicinity of E, a system itself adapted from the (theorem-wise equivalent) system of 'rigorous implication' of W. Ackermann (1896–1962), who really initiated contemporary technical studies in 1956.

A great deal is now known about the main relevance logics, E ('entailment'), R ('relevant implication'), and T ('ticket entailment'), promoted by the Pittsburgh School that flourished around Anderson and Belnap; and also about certain deep relevant logics, the D (for 'deducibility' and 'depth') systems, rival, more appropriately powered systems favoured in Australia. These rival classes do have an important common core, as will be explained in a small technical detour. For all the zero order (or propositional) logics share a common first-degree logic (where no nested implications occur), they are all distributive lattice-based, with a De Morgan negation as opposed to a paradox-inducing Boolean negation (though of course relevantized intuitionisms are feasible). Where the rival classes differ is as to higher degree principles, such as the nested (S3-ish) principle $B \to C \to .\, A \to B \to .\, A \to C$ (typical of strengthening to T), the necessitation theme $((A \to A) \to B) \to B$ (of the stronger E), and the commutation theme $A \to .\, (A \to B) \to B$ (of the still stronger R).

For relevant logics virtually all the interesting styles of mainstream logical formulation have been matched in one way or another: natural deduction, Gentzen, tableaux, semantical, algebraic, and so on (an important exception is resolution, which depends upon irrelevant principles). Moreover, the stronger, relevance logics have proved to have certain interesting technical features, such as undecidability and uninterpolability. Much less is known – yet, for work proceeds apace – about elaborations (e.g. to higher order) and about applications (e.g. in higher mathematics) of relevant logics. But some important results have already been obtained (e.g., positively, R. Brady's on the non-triviality of relevant set theory, and, negat-

ively so far, R. K. Meyer's on the admissibility of Ackermann's rule γ in relevant arithmetic). Less still is known, in the main, about other types of sociative logics. Useful information has, however, been gleaned by a synthesizing strategy: that of carrying these other logics on better-understood basic systems. For example, the systems of analytic implication (worked out by W. I. Parry, following Kantian intuitions, beginning in the 1920s) can be carried by modal logics (upon adding a requirement of content inclusion, as K. Fine showed). Similarly, relevant containment logics can be carried by relevant logics proper; non-transitive relational logics can be carried by modal logics (upon adding a relational coupling), these again having relevant analogues; and so on (for details, see Sylvan *et al.* 1989).

Although the main motivation for investigations of relevant logic was initially philosophical and mathematical – those of paradox, puzzle and problem neutralization or removal – more recently, especially with automatization of logical procedures, these investigations have acquired a technical life of their own in computing and information theory. Early objectives obviously included the quest for satisfactory theories of entailment and implication, theories which were paradox-free and natural but adequate for all legitimate inferential purposes; but also soon envisaged were applications to paradox-removal in mathematics, in the development of coherent type-free foundational systems. Although Ackermann's rigorous implication was not suitable for formalization of non-trivial inconsistent theories (because it contained the primitive rule γ of Material Detachment: A, $\sim A \vee B / B$), subsequent relevant logics were (the main art in reaching system E consisted in deletion of γ, which subsequently proved an admissible rule), and accordingly admit immediate foundational application to inconsistent theories. In fact relevant logics proper form a central sort of paraconsistent logics, logics which allow for handling of inconsistent information, that is, they admit extension by contradictions which do not trivialize them. Because there is no need to reset such systems should they encounter inconsistency (or incompleteness), some of these systems, the deeper ones especially, are ideally suited to neutralize logical and semantical paradoxes. The penalty of triviality such paradoxes carry in stronger and irrelevant settings is defused. With implicational and logical paradoxes eliminated, and therewith many paradoxes parasitic on these (e.g. those of deontic logic, of conditionality, of confirmation theory, and so on), a grander project came into view: total removal of paradoxes of logical kinds, and the development of appropriate logics to implement paradox-freed reasoning satisfactorily. For with the vision came the realization that a great many puzzles, problems, and paradoxes, have been induced elsewhere in theory and in conceptual thought by imposition of the wrong logic or reasoning procedures, typically through disastrous classical procedures. That logical liberation programme is still in process.

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Renaissance Philosophy

Renaissance philosophy refers to a movement that is connected with the renewal of ancient culture, especially in Italy, in the period 1400–1600. This 'humanist' movement is to be distinguished from the university philosophy of this period which continued the

medieval concern with Aristotle's philosophy. Outside the universities Platonism and Stoicism form the background for philosophical reflection and speculation; together with the humanist ideal of individual fulfilment they offer a completion or an alternative to Christianity. University philosophy itself develops autonomously during this period, and becomes more critical towards older interpretations; the most progressive thinker in this respect is Pietro Pomponazzi (1462–1525). The main representatives of the non-university philosophy, in contrast – that is to say, of thinkers at the courts and in the cities – are Lorenzo Valla (*c.* 1405–57), Marsilio Ficino (1433–99), and Giovanni Pico della Mirandola (1463–94). These try to reconcile Christianity and (ancient) philosophy, taking a critical attitude towards medieval positions. Knowledge of the ancient sources increases; manuscripts are discovered and are read in the original Greek or are newly translated.

The main characteristics of the Platonist view of man and the universe are: the universe is infinite and is united by the band of love; in the whole cosmic hierarchy everything has its own place and man is at the centre; by means of love he can strive to higher levels and finally be united with God; but he can also fall and become lower than the animals; his will is superior to his intellect and he has an immortal soul; true knowledge is formed by the intellect and is not dependent upon the senses; the universe is to be understood in its own mathematical order.

Lorenzo Valla was the first great Renaissance philosopher, working in the fields of ethics and rhetorics. He studied in Rome, taught at Pavia, and became secretary to Ferdinand, king of Aragon, and later papal secretary. His most influential work was a handbook of Latin style (*Elegances of the Latin Language*, 1444), but his ethical work was also highly esteemed by many later thinkers, including Martin Luther and Leibniz. He used the dialogue form, perhaps in order to conceal his own convictions, so that there is still discussion about his true opinions. He appreciated the Epicurean moral viewpoint as against that of the Stoics, and seemed to combine the Christian and the Epicurean position by showing that in both cases the highest good consisted in lust and pleasure, either in this life or hereafter.

In his *On Lust* (1431, later called *On the True Good*, 1433) Valla defends the Epicurean ideal of a normal life on earth with its own specific happiness, but this is attacked by the Christian partner in his dialogue. In his *On Free Will*, written between 1435 and 1443, he tries to reconcile God's foresight with human freedom, continuing the argument of Boethius in his *Consolation of Philosophy*. He defends human responsibility, sees human acts as resulting from character and free choice, yet affirms that one's character itself is not chosen, but created by God. It remains a mystery why God created bad people. In his rhetorical work *Dialectical Disputations* (1439) he favours Aristotle against medieval scholastic logic. With critical acumen he discovered that the so-called *Donatio Constantini*, meant to support the papal power, was a medieval forgery.

Marsilio Ficino was the most influential Platonic philosopher of the Renaissance movement. He studied philosophy and medicine in Florence, where one of his teachers was Niccolò Tignosi. He learned Greek and, stimulated by Landino and Cosimo de Medici, started in 1462 his translations of the Hermetica, Plato, Plotinus, and other Greek philosophers and commentators. Also in 1462 the Platonic academy at Careggi near Florence was established as a centre for the study and discussion of Plato's philosophy. Ficino wrote commentaries on Plato's dialogues *On Love* (1469) and systematic works *Platonic Theology* (1482), and *On Christian Religion* (1476). His main concern was to create a synthesis between Christian theology and (Platonic) philosophy; for him both were in harmony and supported each other; faith and reason are in full agreement.

In his concept of God, the universe, and man he sees all three as being connected in mutual relationship in one hierarchical order represented as a circular movement from and towards God. The whole universe is divided into five levels: God, the angelic world, the rational world, qualities, and matter. What binds them together is *eros* or Platonic love (identified with the Christian *caritas*). Man is

in the central position, related to everything, and striving towards his ultimate goal which is the contemplation of God. In so far as he cannot reach this in this life, he will reach it hereafter. Therefore he has an immortal soul; he will gain total knowledge in his eternal life, for real knowledge does not need the body and the senses. The soul participates in the whole universe and transcends its own individual existence. In this way man is 'God on earth'. True morality is not the obedience of prescriptions, but the fulfilment of the contemplative, inner life.

Giovanni Pico della Mirandola was a brilliant representative of Renaissance syncretism. He studied law at Bologna at the age of 14 and philosophy at Ferrara and Pisa, where his teacher was the Jewish Averroist Elia del Medigo. He learned Greek, Hebrew, and Arabic and was very much interested in the Cabbala. In 1496 he planned to defend 900 theses; as an introductory speech he wrote his *Oratio* (later called *Oration on the Dignity of Man*), the delivery of which was, however, forbidden by Pope Innocent VIII. Pico fled to France, was arrested, and was thereafter allowed to stay in Florence (in close connection to Ficino) until his early death.

Pico's intention was more ambitious than that of Ficino. He tried to create one all-inclusive philosophical system, but in fact he was able to present only some few elements of it in his short lifetime. He published an interpretation of the book of Genesis in a cabbalist vein (1489) and combined Plato and Aristotle in *About Being and One* (1491). Pico's view on the universe was not unlike Ficino's. He, too, divided it into different levels in a hierarchical order: God, the angelic sphere, a celestial sphere of the eternal souls, the sphere of man in the centre and below man the lowest sphere of animal life and matter. Man is not fixed in his sphere: he has it in his power to ascend or to descend. The dignity of man consists in his freedom to live his own life. Man is an independent being, free from influence from outside, especially from the stars. Pico attacked astrology because of its determinist tendency. His glorification of man is in sharp contrast with the vision of many contemporary theologians who stressed the misery of man. Pico believes that philosophy is able to develop the human potentialities and find universal truth. In the dream of Jacob about the angels ascending and descending, Pico sees a metaphor of the movement of the universe from and towards God.

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WIM VAN DOOREN

Representation

Representation is bound up with two phenomena: that of one thing (event, state of affairs, etc.) *standing for* another (e.g., a dot on a map standing for a town), and that of one thing *indicating* something about another (e.g., the height of a mercury column indicating the current temperature). Most philosophers have concentrated on *standing for*. The efforts of Charles Sanders Peirce and Charles Morris (1901–79) are notable among modern studies of 'standing for' but neither of them provides an acceptable analysis of the phenomenon.

Peirce wrote (*Collected Papers*, 2.228) that all representation involves a *sign*, standing in some respect for an *object*, so as to bring about the existence of a second sign (the *interpretant*) which also stands for the object. In the central case the interpretant is a mental 'sign' employed by the person understanding the original sign. A sign is a sign *to* a person because it creates a sign of its object *in* the person. For one thing to *stand for* another to an interpreter is for it to be treated by the interpreter, for certain purposes, as if it *were* that other thing (2.273). It remains somewhat mysterious just in what ways names, signal-flags, musical notations, and so on are treated

as if they were the things represented. In addition, on Peirce's theory, any utterance "signifies what it does only by virtue of its being understood to have that signification". This seems wrong; representation may certainly presuppose, e.g., that in most cases there is correct understanding, but it does not require correct understanding in every instance.

Morris provided a clear and non-trivial analysis of what it is for one thing to stand for another (in *Signs, Language and Behavior*, 1946). Following Peirce, he concentrates on things that represent other things *to* interpreters. Morris analyses this relation in a behaviouristic way: a sign creates in the interpreter a disposition to behave, under appropriate conditions, in a goal-seeking manner toward the object. Whatever its merits as a hypothetical *test* for whether something is a sign, Morris's analysis no longer seems a plausible principle about *what it is* for a thing to stand for another.

At first blush, it does not seem very likely that an account of 'standing for' can be given in terms of indication. Surely, indication is the easier notion to grasp; when one thing indicates something about another, some of its features correspond for law-like reasons to certain features of the other thing. Peirce gave the name 'index' to signs that, for reasons of real, causal connections, indicate something about their objects. The problem with explaining 'standing for' in terms of indication is that, first, not every case of indication is either a case of standing for, or even of representation (witness the coloured soil which indicates, but does not represent or stand for, the climatic conditions of its neighbourhood in a certain era); and, second, not every case of 'standing for' is a case of indication (witness false statements, like one of 'David is here', when he is not).

Fred Dretske has presented an analysis of 'standing for' which avoids those pitfalls. A thing stands for or represents another, he claims, when it is its *function* to indicate something about the other thing. Of course, such a thing need not *always* indicate something about its object; in the case of the false statement, the words used stand for their objects in virtue of their linguistic function of indicating facts about these objects, *not* because they indicate such facts on the occasion of that statement. The analysis also avoids the other problem with assimilating 'standing for' to indication: the soil's colour indicates facts about the climate, but it is in no sense its *function* to do so. It is an open and interesting question whether the elusive notion of 'function' can bear the weight placed on it in Dretske's analysis. Certainly, the analysis seems more satisfactory with regard to the central cases of mental and natural-language representation than it does with regard to musical notation, artistic depiction, and allegory.

Complex Representation. Although Ludwig Wittgenstein shed no light on what it is for a thing to stand for another, he gave in the *Tractatus* an interesting account of how structured combinations of signs can represent possible states of affairs. According to his 'picture theory' of representation, a complex sign like a sentence shares a logical form with, or is isomorphic to, the state of affairs it represents. The component signs stand for things and relations, and the holding of structural relations among the component signs within the complex sign reflects the logical structure of the represented state of affairs – determining just which relations are represented as holding between which objects. For example, suppose that 'the cat' stands for the cat, 'the mat' stands for the mat, and 'is on' stands for the relation of being atop. Consider, now, the sentence 'the cat is on the mat'. Wittgenstein held that it is the *fact* that, in the sentence, the term 'the cat' stands to the left, and 'the mat' to the right, of 'is on', that represents the state of affairs of the cat being atop the mat. Very roughly, representation of complex states of affairs demands structural isomorphism between the representation and what is represented. The isomorphism presupposes an unexplained 'projection' relation which relates the simple, component signs with the things and relations they stand for, and which relates structural features of the complex sign with logical features of the designated state of affairs.

Intentionality. In the philosophies of mind and language, discussions of representation

are bound up with debates about 'intentionality'. Our thoughts and words are *about* things; things are represented in thought and language. A live issue in this area is whether or not the representational ability – the intentionality – of language is derivative upon that of mind: can we talk about things only because we can think about them? This thesis has been defended, as has the opposite thesis, that the intentionality of thought is dependent on our abilities to use language.

Artificial Intelligence. The view that mental representation involves an organized system of mental entities is familiar from theories of concepts and ideas, and has been given new support by advocates of *representationalism*. Recent work in artificial intelligence and cognitive science under the name of 'knowledge representation' explores formal, computational models of mental representation (see Brachman and Levesque 1985). A widely held thesis in this field is that mental representation demands a *system of representations* – a language-like vocabulary of structured states or objects internal to the mind, which is endowed with representational ability, and upon which the mind operates computationally (see Fodor 1975). This thesis may be placed in some peril by the success of 'connectionist' models of various cognitive phenomena, notably memory and language understanding, which one might have expected to be the chief grist for the conceptualist mill. Connectionist models involve networks of simple *units*, or processing nodes, together with connections of various *weights*, or strengths, between them. While it is plausible to hold that connectionist systems perform representational tasks, one is at least uncomfortable with the claim that they do so in virtue of having a system of *representations*. Such a system, which can represent, or remember, many states of affairs simultaneously, does not break up naturally into parts which themselves represent states of affairs. Instead, the burden of representation seems to be *distributed* in a very woolly way across the entire system (see Rumelhart and McClelland 1986).

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MARK CRIMMINS

Roger Bacon

Roger Bacon (*c.* 1214/20–92) lectured on the *Physics* and *Metaphysics* of Aristotle at Paris sometime between 1237 and 1247. His metaphysics and ontology, however, are not purely Aristotelian. He interpreted Aristotle with the aid of Neoplatonic sources. The *De hebdomadibus* of Boethius, the *Fons vitae* of Avicebron (Ibn Gabirol), the *Metaphysics* of Avicenna, and the *Liber de Causis* are the texts which Bacon used to interpret the problems in the Aristotelian *Metaphysics*.

Bacon's philosophy divides into two separate parts:

1. His early commentaries on Aristotle and the *Liber de Causis* (*c.* 1237–47).
2. His later works *c.* 1247–92, especially 1266–92.

The latter emphasized grammar, logic, language studies, mathematics, optics, experimental science, and moral philosophy. Unfortunately, he left no treatise on metaphysics or on ontology from this period. His ideas on these topics have to be discovered from his *Communia naturalium*. The one work from this period entitled *Metaphysica Fratris Rogeri* (= *Opera*, ed. Steele, Fasc. I) is a rhetorical piece concerned with the vices treated in the study of theology. None the less, from a reading of this work and from the *Moralis philosophia*, one can discover that in his later works there is a marked tendency on

Bacon's part to subordinate an Aristotelian ontology to a Neoplatonic metaphysics, and to subordinate metaphysics to morals.

Bacon's doctrine of the ontology of the person is clearly influenced by Boethius; Bacon's rejection of the agent intellect as a part of the soul, and his identification of the agent intellect with God as illuminative source is clearly a favouring of Neoplatonic metaphysics. The close connection between metaphysics and morals is in imitation of Avicenna. Bacon's theory of universal hylomorphism and plurality of forms simply reproduces the doctrine of Thomas of York (*c.* 1200–60) as represented in the latter's *Summa sapientiale*. Indeed, Bacon's work makes no advance at all on Thomas of York and Robert Kilwardby (1215–79).

The central doctrine of Bacon's physics and metaphysics is his account of the multiplication of species. Central to this is a physics of light. Its proximate historical origin is the metaphysics of light in Robert Grosseteste (*c.* 1168–1253). Species is not Porphyry's fifth universal. It is the name for the first effect of any naturally acting thing. In any natural action, the agent changes the matter so that a form can be brought forth. Bacon treats of being and becoming in the context of his account of generation. For Bacon, generation confers existence on things. And like all forms of becoming, generation in the strict sense, that is, animate generation, involves a material, a formal, an efficient, and a final cause.

For Bacon, matter has a number of meanings:

1. Matter as the subject of action,
2. Matter, in its most proper sense, as the essence that with form constitutes the composite, and which in this manner exists in every created substance,
3. Matter as the subject of generation,
4. Matter as the subject of alteration,
5. Matter as individual in relation to universal.

In brief, Bacon, following Thomas of York, holds that matter in essence is ingenerable and incorruptible; it is generable only by accident and through privation. It is the subject of contraries and is knowable only by analogy with form.

Bacon rejects a nominalist account of universals. Scholars disagree as to whether Bacon's account of universals is one of moderate or extreme realism. In *Communia naturalium* (from 1260s), Bacon assigns ontological priority to individuals over universals. In doing so, he anticipates Duns Scotus in speaking about the absolute nature of the individual as something that is more important than the universal by which one individual agrees with another.

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JEREMIAH M. G. HACKETT

Royce, Josiah

The main metaphysical works of Josiah Royce (1855–1916) are *The Religious Aspect of Philosophy* (1885), *The Spirit of Modern Philosophy* (1892), *The Conception of God* (1897), *The World and the Individual* (1900, 1901), and *The Problem of Christianity* (1913). Royce argues for absolute idealism through reflections on the relation between an 'idea' and its object. These show that the universe is an infinite eternal thought (alias the Absolute, the ultimate self, or God), which experiences itself as a single unit. Its basic elements are finite states of mind like ours, organized into finite selves, and other units of the same essential kind.

The argument in *The Religious Aspect of Philosophy* is roughly this. Whatever else may be doubtful one thing is for sure, that there is such a thing as error. For the belief that there is cannot be false; if it is true, then there is error, while if, *per impossibile*, it is

not, *it itself* would be an error. Even so, there is a problem as to how error is possible. For it can only consist in an idea which misrepresents the character of its object. But how can an idea ascribe to its object any character which clashes with what it is envisaged as possessing? For no merely causal account of how an idea is related to its object is viable. Instead it must pick it out either by the way it depicts it or through an immediate confrontation. But in the first case it can pick out only its own intentional content and cannot but depict it correctly and, in the second, only what is so present to it that error is impossible.

For a solution we must examine falsehoods recognized as such. If I attend to some present content of consciousness I can entertain false thoughts about it, e.g. that this blue sense-impression is red. Here the sense-impression is my idea's object because it is consciously directed towards it, and the idea is false as predicating of it what manifestly clashes with its given nature. Now suppose that there is a consciousness in which an idea is similarly applied to some content which it manifestly misrepresents but that the idea (and not the content) falls within some part of the total consciousness with an illusory sense of itself as a unit on its own (an illusion manifest to the including but not to the included consciousness). Then the idea could be an error, for it could contain some dim sense of being about something beyond its own boundaries while envisaging that only in the character it predicates of it. Such, indeed, contends Royce, is the only possible account of error, which shows that our thoughts, as possibly erroneous, must be elements in a more comprehensive mental totality which includes everything they are capable of being about, in short, everything.

One might object that an error need not be 'about' some actual object. It may simply say that there is something which there is not. However, Royce claims that our 'ideas' or thoughts always have a certain *de re* character, even if only by being about some time beyond the present.

Royce's argument may impress more now than in the heyday of Bertrand Russell's theory of descriptions, which might once have seemed to provide its refutation. For the *de re* element in thought is now widely emphasized, while usually explicated in causal terms along lines Royce effectively criticized. As it is, the most notable response to it to date is that of William James whom it stimulated to the pragmatist view that the object of an idea is that with which it prepares us to cope practically.

In *The World and the Individual* Royce reaches the same point via an enquiry into the meaning of 'to be'. This is assimilated to the question what it is for there to be a thing such as some idea posits. He describes three traditional answers and proposes his own fourth.

1. For the realist conception the object posited by an idea *really is* if and only if its possession of its own character is logically independent of the possession by the idea of its. Royce professes to show the impossibility of such independence by two (shaky) arguments.
2. The mystical conception identifies being with an immediate experience in whose luminous presence all ideas of it or of anything else must simply fade away. Royce objects that ideas, after all, have their own being and that a reality incompatible with their presence has no claim to be a reality.
3. The critical rationalist view (typified by Kant) identifies the being of the object of an idea with the possibility of experiences which the idea would recognize as verifying it. But this, says Royce, rests on a notion of possibilities and of counterfactual conditionals which can only be explicated by a more basic notion of the object's being. Moreover, a genuine existent must have an individuality not fully cashable in the universals by which a merely verifiable, and not verified, idea can alone specify its object.
4. The fourth conception utilizes a contrast between the internal meaning of an idea, roughly its intension, and its external meaning, roughly its extension or reference. The first is an incompletely fulfilled purpose which the idea feels itself as embodying, while the

> second can only be an experience of that purpose's complete fulfilment. This must be actual, not merely possible, if the idea has an object to be right or wrong about. Thus every idea points to an all-containing consciousness in which it is felt together with some fuller experience of which it is the more or less adequate intimation. The distinction between thought and will is superficial, since a true thought is a satisfied volition, satisfied, at least, in the Absolute (hence Royce calls himself an 'absolute pragmatist').

Royce is clearer about time and eternity than most absolute idealists, exploiting brilliantly the notion of a specious present. The duration of these varies greatly, and the 'in itself' of most of the physical world consists in minds so different in this respect from ours that social relations between us are impossible. The total Universe or Absolute is a frozen specious present and it feels within itself the genuine temporal relations between its elements. However, it is not itself in time for it does not emerge from or pass into any other experience.

In opposition to F. H. Bradley and others, Royce thought a mathematical model of how the Absolute combines the many into one possible. Discoveries such as Georg Cantor's (1845–1918) and Richard Dedekind's (1831–1916) put paid to Hegelian objections to the 'bad' infinite of mathematics and to Bradley's objections to relations for leading to an infinite regress. (He acknowledged, however, that his own main argument was an application of Bradley's principle that relatedness can only hold within a concrete whole.) The Absolute experiences the actual infinity of details that follow from the freely chosen formula by which it defines itself as an infinitely self-representing conscious system of such systems. But Royce's discovery of defects in his handling of such topics in *The World and the Individual* led to substantial revisions of his metaphysics in *The Problem of Christianity*. Here the felt unity of the Absolute, if not abandoned, falls into the background and it is depicted rather as a community of minds, or more ultimately (inspired by C. S. Peirce's doctrine of signs) a network of ideas the meaning of each of which is interpreted to another idea by a mediating idea.

Evil, like error, is central to Royce's thought. The model for both lies within our own consciousness. The highest good we find there is the overcoming of our own evil propensities and weaknesses. This shows how evil at large may be an essential ingredient in the greatest good there can be, that of an infinite series converging on a limit situation in which it would be finally overcome.

Royce's metaphysics was closely related to his ethics. Initially moral goodness was characterized as an openness to the aspirations of all other consciousnesses falling within the single absolute consciousness. Later it was identified with loyalty to loyalty, that is, a loyalty, to some community or cause, which encourages all others in loyalty to their own community or cause. Royce is also important in the history of formal logic in the United States.

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TIMOTHY L. S. SPRIGGE

Russell, Bertrand

Bertrand Arthur William Russell (1872–1970) attended Trinity College, Cambridge (1890–94) where he was 'indoctrinated' with the philosophies of Kant and Hegel, and where he was awarded a fellowship (1895–1901) and later became a lecturer in philosophy (1910–16), a position he lost in 1916 because of his militant pacificism. His public written advice to conscientious objectors led to his imprisonment for six months in 1918. He subsequently visited Russia, lectured in China, and later held professorships at the

universities of Chicago and California. In 1944 he was re-elected to a fellowship at Trinity, and in 1950 he was awarded the Order of Merit and the Nobel Prize for Literature.

Russell held a number of different metaphysical positions throughout his career, with the idea of logic as a logically perfect language being a common theme that ran through each. His first such position, when he was still a student in 1894, amounted to a brief flirtation with absolute idealism and the doctrine of internal relations, from which he quickly moved on to a form of semi-Kantianism that he defended in his 1896 book on the foundations of geometry. In that book Russell agreed with Kant that the mind must innately possess some form of externality in order to experience space; but whereas for Kant Euclidean geometry provided the *a priori* laws that explained our experience of space, for Russell it was the *a priori* laws of projective geometry (which includes non-Euclidean as well as Euclidean geometry as special cases) that were the logically necessary basis of any form of externality.

By the turn of the century, under the influence of G. E. Moore, Russell rejected all internal relations and developed a form of realism that he called pluralism but which today would be called a possibilist form of Platonistic logical realism. The position was possibilist because it was committed to there being possible real concrete objects (such as the objects of fiction) that do not in fact exist but which could have existed had certain propositions having those objects as constituents been true. (Contrary to a view sometimes ascribed to him, Russell was never willing to admit into his ontology the impossible objects that he thought Alexius Meinong was committed to.) The possibilism lasted until 1905 when, armed with his new theory of denoting, Russell came to believe that merely possible objects were superfluous and could be analysed away in terms of his now well-known theory of definite descriptions. The Platonism remained, however, in Russell's continued commitment to such abstract entities as properties, relations, and propositions. The position was Platonist not only because predicates and sentences were taken to stand for such abstract entities, but also because, unlike Gottlob Frege's form of logical realism, the same abstract entities were taken as the *denotata* of the nominalized forms of those predicates and sentences as abstract singular terms. (Russell briefly held a quasi-Fregean view in 1898 when he maintained, e.g., that *human* does not have being until it is transformed into a term, humanity; but he later rejected that view.)

A fundamental notion of Russell's logical realism, sometimes also called ontological logicism, was that of a propositional function, the extension of which Russell took to be a class as many. Initially, as part of his response to the problem of the One and the Many, Russell had assumed that each propositional function was a single and separate entity over and above the many propositions that were its values, and, similarly, that to each class as many there corresponded a class as one. Upon discovering his paradox, Russell maintained that we must distinguish a class as many from a class as one, and that a class as one might not exist corresponding to a class as many. He also concluded that a propositional function cannot survive analysis after all, but 'lives' only in the propositions that are its values, i.e. that propositional functions are nonentities.

In his 1906 substitutional theory, Russell attempted to carry out his logicist programme without assuming the existence of either classes or propositional functions. Being was univocal in this framework in the sense that every entity, whether concrete or abstract, was assumed to be the value for a single type of unrestricted variable. Properties, relations, and propositions, but not classes or propositional functions, were all values of that variable. The proposed reduction of classes and propositional functions was given in terms of a double form of quantification over propositions and their constituents as values of the one type of unrestricted variable. (E.g., instead of $(\varphi)(\varphi x \supset \varphi y)$ to express the indiscernibility of x and y, Russell's 1906 substitutional notation gives us $(p)(z)(p/z\,;x \supset p/z\,;y)$, where $p/z\,;x$ stands for the result of substituting x for z in p.) But this reduction was problematic, and in 1908 Russell abandoned the idea of a univocal mode of being

and developed instead a theory of ramified types in which being was partitioned into an infinity of different logical types, with concrete particulars as the objects of the lowest type. (Contrary to his earlier terminology, Russell now took only concrete particulars to be 'individuals', while the notion of an object became systematically ambiguous and carried the burden of the 'individuality' of the abstract entities as well. This shift in terminology has misled some philosophers into thinking that Russell's theory of types can be given a nominalistic interpretation.)

Classes now were taken as analysable in terms of propositional functions, even though the latter were still construed as nonentities, i.e. as reducible to the many propositions that were their values. Later in 1910, the ontological roles of propositions and propositional functions were reversed; i.e. propositions were then taken as nonentities while each propositional function was assumed to be (or to have corresponding to it) a real property or relation. This reversal was a consequence of Russell's rejection in 1910 of his earlier theory of belief and judgement (as a relation between a mind and a proposition) in favour of his then new multiple relations theory (as a relation between a mind and the constituents or components of a proposition), which required that propositional functions, but not propositions, be real single entities.

As a result of arguments given by Ludwig Wittgenstein in 1913, Russell, from 1914 on, gave up the Platonistic view that properties and relations could be logical subjects. Predicates were still taken as standing for properties and relations, but only in their role as predicates; i.e., nominalized predicates were no longer allowed as abstract singular terms in Russell's new version of his logically perfect language. Only particulars could be named in Russell's new metaphysical theory, which he called logical atomism, but which, unlike his earlier 1910–13 theory, is a form of natural realism, and not of logical realism, since now the only real properties and relations of his ontology are the simple material properties and relations that are the components of the atomic facts that make up the world. Complex properties and relations in this framework are simply propositional functions, which, along with propositions, are now merely linguistic expressions. (Russell remained unaware that as a result of the change in his metaphysical views from logical to natural realism his original theory of types was restricted to the much weaker sub-theory of ramified second-order logic, and that he could no longer carry through his logicist programme. This reinforced the confusion of nominalists into thinking that Russell's earlier theory of types could be given a nominalistic interpretation, since such an interpretation is possible for ramified second-order logic.)

From 1914 to 1940, the simple particulars of Russell's atomist ontology were events; ordinary physical objects were analysed as complexes constituted of a 'compresence' of events. From 1940 on, Russell took events to be themselves complexes consisting of a compresence of simple qualities, where a complete complex of compresence of such qualities was to count as a space-time point. Ordinary physical objects were then taken to be bundles of such simple qualities. Russell believed that such a move allowed him to adopt a weakened form of the principle of atomicity according to which a name in the atomic sentences of his ideal language could name a complex even though the name itself must be logically simple and must not be allowed to exhibit the structure of that complexity.

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NINO B. COCCHIARELLA

S

Santayana, George

George Santayana (1863–1952), the Harvard Spaniard, developed an elaborate ontology in his later, far too little appreciated work.

He is sometimes misunderstood as a philosopher primarily interested in the claims of scepticism when, in truth, he wished to free philosophical construction from the supposed need to combat it. He argued that all partial scepticisms (e.g. like those he thought basic to idealism) are based on principles whose logical culmination is in a "scepticism of the present moment" or even a mere contemplation of 'essences' not recognized as existing at all, and that since these are stances no one can genuinely endorse or recommend, scepticism should no longer haunt philosophy. The proper course for the philosopher, then, is to work out a view of things frankly based on "animal faith", that is, on our practically compulsory beliefs as to what is, and as to what methods can reveal more of what is, dropping only those beliefs which animal faith itself eventually bids us discard.

On this basis Santayana committed himself to what he misleadingly called 'materialism', the view that the only genuine explanations of phenomena are physical. However, besides "the realm of matter" he recognized three other realms, of essence, of truth, and of spirit. Spirit is essentially consciousness, something he thought produced by, and entirely determined in its course by, physical processes. It arises when organisms develop brains and sense organs which respond to external stimuli in ways which promote survival and successful procreation. This epiphenomenalist doctrine is accompanied by a conception of the psyche, which is tantamount to the conception of mind advocated by a modern materialist like David M. Armstrong. Santayana's account grants all that is positive in such a conception, but insists that as well as the mind in that sense there is spirit or consciousness. This is a quite novel form of being through presentation to which (in a form highly relative to the needs of the particular organism) the natural world first acquires genuine values, positive and negative.

Essences for Santayana are the forms and qualities which existent things may or may not possess. Whether any existing things actualize these essences or not makes no difference to their being as essences. If some quality, which some thing actually has, had not been possessed by anything, then it would have been true that nothing possessed it, and that means that it, whether simple or complex in its constitution, and whether any mind could or could not have conceived of it, would have had the eternal being of something which might have been actualized in existence. Santayana's is a doctrine of unactualized essences, not of non-existent particulars, such as figure in the philosophy of Alexius Meinong. However, essences include absolutely specific forms of being such as might constitute the whole of what some particular was within its own bounds, as well as more generic properties; relations are also covered though seen as posing special problems.

There are some unclarities in Santayana's account of truth but essentially he held that whether anyone knows it or not, there is a precise truth as to the character and relations of each thing and of the existent world as a whole. True thoughts are true because they envisage such a truth, but whether envisaged or not, the truth about a thing is neither a thought in anyone's mind about it, nor the thing itself, nor the mere essence of the thing as an eternal element in the realm of essence. Thus truth is a further realm of being, though in a sense a hybrid one in which eternal essence and existent particular meet. Santayana's treatment of truth is related to a profound treatment of time.

To have literal knowledge of a truth about something is to intend that something and envisage it with that essence. The essence is exemplified in a special 'objective' manner in consciousness but the associated feeling of intending-an-existent-object only homes in on a definite actual object in virtue of the organism's causal or behavioural relation thereto. Most knowledge, moreover, is symbolic rather than literal. In this the

essence exemplified in our mind is not an actual essence pertaining to the object but only an appropriate rendering of that object for the consciousness of an organism which must deal with it. (Some think Santayana's epiphenomenalism is under strain here; however, there is no actual inconsistency.) In either case what makes it knowledge, rather than mere belief, is that it is a belief generated in ways which typically do generate true belief. The similarity to many modern accounts of knowledge will be clear.

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TIMOTHY L. S. SPRIGGE

Sartre, Jean-Paul

Jean-Paul Sartre was born in Paris in 1905. He taught philosophy in various *lycées* until 1944. After 1945, he created *Les Temps Modernes* and participated in many political activities. His work ranges from philosophy to literature. He was awarded the Nobel Prize, which he refused, in 1964. He died in Paris in 1980. From the beginning of his philosophical career before World War II, Sartre had attempted to build a philosophy of psychology based on the notion of consciousness. In his first important philosophical work, *The Transcendence of the Ego* (1936), he used Edmund Husserl's notion of intentionality to show that the ego is not *in* consciousness, but *outside* it, in the world upon which it is 'projected'. He thereby shows how consciousness 'irrealizes' itself by creating imaginary objects. His major philosophical work, *Being and Nothingness* (1943), takes up these themes and attempts to build a 'phenomenological ontology'. But like most of his French contemporaries, Sartre's 'existentialist' version of phenomenology owes little either to the Husserl of the *Logical Investigations* or to the idea of phenomenological reduction, and is by no means a 'formal ontology'. Intentionality, for Sartre, is not the basis of an intuition of essences, and does not create a realm of intentional *objects*.

Sartre owes as much to Hegel as to Husserl or Martin Heidegger. The basic ontological structure in *Being and Nothingness* is dualistic: it rests upon the Hegelian categories of the "in-itself" and the "for me". Very little is said of being in-itself, except that it is pure indifference and identity to itself. The "for me", on the contrary, is pure difference and opposition, and cannot be assimilated to a thing or substance. Its nature is consciousness, which is the pure negativity, or power to create nothingness, by which Sartre defines freedom. Sartre reaches this conclusion through an analysis of time. The passing of time, as it is experienced by a conscious being, creates a gap which is the origin of our notion of the absence of an existing thing. The gap created by this experience of negation is our freedom, which can be experienced in such a feeling as anguish.

Consciousness (mine or another's), and the fact that my world is shaped by the consciousness of others, is one of the dominant themes of Sartre's work. This reduces being to appearance, *esse* to *percipi*. Every attempt to eliminate the essential non-identity of consciousness to itself is the source of what Sartre called "bad faith". This is not (like self-deception) a psychological, but an ontological, phenomenon. Most of the "phenomenological descriptions" of *Being and Nothingness* are – in conformity with the existentialist slogan 'existence precedes essence' – descriptions of *situations*, through which Sartre creates a new *genre* (in parallel with his own literary work), the genre of the ontological novel (such are the famous descriptions of the waiter, the seduced woman, and many other 'ontological' anecdotes).

Absent from Sartre's work is the idea of an ontological structure which would pre-exist the dual ('dialectical') structure of the in-itself and the for-me. There is no other possibility for apprehending being than the perspective of human subjectivity. Every

other perspective would amount to a claim that being 'invents' man, instead of the invention of being by man that is proposed by Sartrean existentialism. Sartre has never given up this position. It was the basis of his later attempts (in the *Critique of Dialectical Reason*, 1960) to promote an existentialist version of Marxism, against what he took to be more or less theological versions of this doctrine (he had a similar reaction towards the late Heidegger, Maurice Merleau-Ponty, and the 'structuralist' philosophers). On this analysis, social groups take over from the individual of Sartre's earlier works. They are the active subjects of a history which they create freely against a background of determined circumstances.

Sartre described his philosophical work as an attempt to overcome the traditional alternative between realism and idealism, and to repudiate any version of substantialism. But it may be asked whether his ontological dualism is not a radicalization of Cartesian dualism, and whether his definition of being as freedom does not amount to locating within subjectivity that contingency which the 19th-century French spiritualists (from Félix Ravaisson to Charles Renouvier and Henri Bergson) located within nature.

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PASCAL ENGEL

Scepticism

The term 'scepticism' refers to positions and attitudes in epistemology or the theory of knowledge. Most people associate with scepticism the *position* that nothing can be known for certain. This conception of scepticism can be found already in early Christian philosophy (Augustine, *Contra Academicos*) and it has been prevalent since the Middle Ages. But 'scepticism' is used also in connection with a tradition in ancient philosophy and, in this case, the term refers to an *attitude or a mental capacity*:

> Scepticism is an ability, or mental attitude, which opposes appearances to judgements in any way whatsoever, with the result that, owing to the equipollence of the objects and reasons thus opposed, we are brought firstly to a state of mental suspense and next to a state of "unperturbedness" or "quietude" (Sextus Empiricus, *Outline of Pyrrhonism*, Loeb Classical Library, trans. R. G. Bury, I, 8).

Scepticism in this sense was applied not only to claims to certain and justified knowledge but also and probably foremost to beliefs as to the real nature of things.

Taken both ways, as a position and as an attitude, scepticism has primarily to do with the theory of knowledge. But it can be brought to bear on problems of metaphysics and ontology by being applied to claims to metaphysical or ontological knowledge. A sceptical *position* declares metaphysical and ontological knowledge to be impossible. The sceptical *attitude* or capacity opposes metaphysical and ontological beliefs and results in suspense of judgement. At first blush, then, either brand of scepticism seems to have negative implications only with regard to metaphysics and ontology and seems not to be committed to any metaphysical or ontological stance.

At closer analysis, however, this impression cannot be upheld. For it can be argued – as we shall presently see – that scepticism in either form shares assumptions which are made also by metaphysical realism. I take it that metaphysical realism is the conjunction of three theses:

1. Human judgement has the power of representation; i.e. human judgements are true or false descriptions of – in general – judgement-transcendent subject matter.
2. Reality represented is – in general – causally independent of its being represented (correctly or incorrectly) by human judgement and the way of its being thus represented.
3. Human judgement can reach a knowledge of reality, and, as a matter of fact,

> to a certain degree we obtain such knowledge.

1. is a semantic thesis, 2. might be considered the metaphysical thesis of realism, and only 3. is of epistemological character.

Obviously, scepticism does not opt wholesale for metaphysical realism. This is so because scepticism does not adopt the epistemological thesis 3. On the other hand, it seems as though the metaphysical and the semantic theses are presupposed by scepticism. In order to show this I shall first discuss strategies used by ancient sceptics for bringing about suspense of judgement in themselves and in others. Then I will take a very cursory look at modern scepticism; that is, sceptical traditions since the 16th century.

Sextus Empiricus (*c.* 150 – *c.* 225) in his *Outline of Pyrrhonism* describes the strategies adopted by the ancient scepticist. As can be seen from the above quotation the moving force of the sceptical attitude in antiquity was the hope of reaching mental quietude. The sceptics started this process by opposing each judgement to an equipollent alternative. They believed that people do not take a firm stance on a subject matter when confronted with equally plausible alternatives. In this way the sceptic comes to suspense of judgement, a state of mind in which he does not affirm or deny anything. This procedure involves metaphysical realism (minus thesis 3.) in two ways.

First, it seems to be suggested that there is a reality independent of human judgements and of the people passing judgements, a reality with things having an ultimate nature. This is indicated by the sceptic's use of terms like φαινόμενον and φύσις. Central to the sceptic's procedure is the opposition of different 'appearances' (φαινόμενα): it is assumed that things can appear in different ways to different persons or even to the same person. If these appearances are equipollent we are led to suspension of judgement with regard to the φύσις of the things investigated. Here φύσις seems to refer to the nature of things, to how things really are (e.g. *Outline*, I, 27, 28, 30, 59; see also Sextus's talk of τὰ ἔξωθεν ὑποκεῖματα – i.e. of external substances or external realities, e.g. I, 54). Whereas the appearances vary, the nature of things, their φύσις, is taken to remain fixed.

Second, the sceptical strategy brings different appearances into opposition to each other. The appearances are opposed to each other, ἀντικεῖμενα. But what does it mean for judgements or appearances to be opposed to each other? When confronted with opposing appearances, says Sextus, we cannot assent to all of them. For in this case, "we shall be attempting the impossible and accepting contradictories" (I, 88). Hence, if opposed judgements or appearances are equipollent we are led to suspension of judgement. This suspension is, as we have seen, with regard to the φύσις of things, their real nature. The suspension of judgement, thus, seems to regard the *truth* of the judgements involved. Two judgements, then, are opposed to each other if it is impossible that both can be true at the same time. This talk of opposition seems to presuppose that judgements can be true or false descriptions of the nature of things, and this means that they have the power of representation. Thus, ancient scepticism is committed also to the semantic thesis of metaphysical realism.

Sceptical strategies in antiquity were connected with scepticism as an attitude and were aimed at the quietude of mind. Modern sceptical strategies are linked to scepticism as a position (which may be either merely entertained or fully adopted) and are less practically oriented. Many thinkers used sceptical arguments for the defence of Christian faith against possible clashes with claims of reason (see Richard H. Popkin, *The History of Scepticism. From Erasmus to Spinoza*, 1979). Other thinkers used sceptical strategies as preparatory to the attempt to give a foundation for metaphysical and scientific knowledge. But this modern kind of sceptical thought also presupposes the semantic and metaphysical parts of realism. A case in point is René Descartes. In his *Meditations*, with the method of universal doubt he wanted to liberate the mind from all prejudice and make it capable of indubitable true judgement (see the first Meditation). Universal doubt was used to make plausible the position that all our beliefs, perceptual and otherwise, could be false. An evil demon

might deceive me completely with regard to the external world and even with regard to my body and mind. This sceptical strategy also operates with the concepts of truth, falsity, and deception. Thus it acknowledges that human judgement has the power of representation, even though it may misrepresent reality. With this it is supposed that the external world, and even our body and mind could be otherwise than we judge them to be. The way they are is taken to be independent of our judgement. Therefore, also the metaphysical thesis of realism is presupposed.

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AXEL BÜHLER

Schapp, Wilhelm

Wilhelm Schapp (1884–1965) took his doctorate under Edmund Husserl in Göttingen with a dissertation entitled *Contributions to the Phenomenology of Perception (Beiträge zur Phänomenologie der Wahrnehmung*, 1910). Here Schapp utilizes the phenomenological method of description in an attempt to save reality (the 'world of things') from empiristic phenomenalism. For Schapp, it is not only impressions and ideas that are given immediately to consciousness, but also relations between these, which differ from arbitrary associations and bear some relation to the perceptual structures later investigated by the Gestalt psychologists. In the form of perception the structure of the world of things is thereby already implicit. In accordance with Husserl's concept of the intentionality of consciousness, Schapp interprets the relation between the subject and its objects not as a picturing or copy relation but as a matter of representation.

The representation theory proves however to be insufficient, for it remains unclear how pure thoughts (relations, ideas) can be transformed into concrete reality. Ontology, as the analysis of forms, becomes a theory of representation. At this point the latent idealism of phenomenology clearly emerges. In this way it is not possible for a phenomenologist like the early Schapp to get beyond what amounts to a sort of perceptional fictionalism.

Gradually, however, Schapp recognized the lack of reality in his representation theory. In his book *Entangled in Stories* (*In Geschichten verstrickt*, 1953) he broke away from the phenomenological theory of perception. Instead he adopts a kind of pragmatist viewpoint, in which reality is seen as being tied to the context of human actions and life. Not the immediate data of perception but man's entanglement in what Schapp calls 'stories' or 'histories' (*Geschichten*) forms the fundamental element of experience, beyond which we cannot penetrate. 'Entanglement in stories' therefore corresponds to a sort of Heideggerian 'being in the world'. In stories, reality is experienced not as a world of things but as a world of 'things of use' (*Wozudinge*) whose reality consists only in the context in which they are produced and used.

In his later works, Schapp tried to transform the ontological categories of the tradition into structural forms of 'stories'. In this way he performs a sort of linguistic turn in philosophy without however lapsing into an analytical formalism. For the structural forms of stories are forms of speech but, at the same time, also forms of life. In his *Philosophy of Stories* (*Philosophie der Geschichten*, 1959) Schapp rightly rejects Husserl's 'idea of pure grammar' as insufficient basis for the constitution of reality. This is because it abstracts from the performative dimension which, through our fundamental entanglement in stories, remains ever present.

One difficulty in Schapp's position is: how can the idea of 'entanglement' be brought into conformity with the 'narrative scheme' as this is described by A. C. Danto? For surely, in order to be able to narrate one must

already have distanced oneself from entanglement. Life has to be transformed by fantasy into symbolic pictures. At this point it appears that aesthetic moments become important for the narrative constitution of reality.

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FERDINAND FELLMANN

Scholasticism. See: **Aristotelianism; Distinctions; Peirce and Scholastic Metaphysics; Scotism,** and articles on individual Scholastics.

Scholasticism, Post-Medieval I: 15th and 16th Centuries

The greatest centuries for Scholasticism were the 13th and 14th, but it continued to flourish thereafter, even though coming under strong and increasing attack, especially from the humanists. Lorenzo Valla (1407–57), for example, believed that the scholastic preoccupation with a certain type of logic had been disastrous for metaphysics. This logic was based on a highly artificial language, a 'scientific' Latin, which was far from the linguistic practices of ordinary people, practices by which people were well equipped, linguistically at least, to talk about reality; but the sheer artificiality of the language of the scholastic logicians, Valla held, made it impossible for them to make serious advances in the philosophical enterprise of revealing new and profound truths about reality. In this criticism Valla was followed by Rudolph Agricola (*c.* 1443–85), and in the following century by Peter Ramus. Whatever the merits of this criticism, however, important work in the field of metaphysics and ontology continued to be done, and by men who had been educated in the despised logic of the Scholastics.

Amongst those who made a major contribution to scholastic metaphysics in the 15th century is Nicholas of Cusa. As with all scholastic philosophers, his metaphysics are God-oriented although, in line with a well-established tradition, he stressed the fact that the chief topic of metaphysics, the being of God, is opaque to human understanding.

We find within the created order, according to Nicholas, a whole host of differences and oppositions, and of course in the created order oppositions must remain even though we might regard ourselves as committed by our nature to an ethical imperative to seek to overcome oppositions, and to replace them by harmony and synthesis. At the heart of Nicholas's metaphysical system lies precisely this concept of a harmonization of the differences which characterize our world. What differences and oppositions are at issue here? Among them are unity and multiplicity, and essence and existence. Each of us is one, but a one which is characterized by a configuration of many distinct parts and features. Each of us has an essence but it is no part of our essence that we exist. Whatever exists, other than God himself, exists by virtue of an act of God's will, not by virtue of its own nature. Nicholas's doctrine is that God exists as a *coincidentia oppositorum*. Opposites which characterize creatures exist in God without being in opposition to each other. He transcends them, though he does so in a way we cannot grasp.

Most especially, the distinction in us between essence and existence is not a distinction in God. His essence is to exist. This chief metaphysical opposition in creatures is, then, one in God. But having said all that, Nicholas reminds us of our inability to grasp the mystery of this oneness; we can at best grasp its mysteriousness. By an exercise of reason we can follow through the logic of the concept of God as the coincidence of opposites, but the knowledge yielded up by this exercise of reason is not positive knowledge. It is negative. We remain ignorant. This is not, however, the ignorance of the unedu-

cated person, but of the metaphysician who has such a clear grasp of the metaphysical realities that he knows *why* he is and, in this life, must remain ignorant. Hence the title of Nicholas's most famous work, *De Docta Ignorantia* (Educated Ignorance). In adopting this epistemological response to the metaphysical verities he has presented, Nicholas is clearly an heir to a tradition which had included central figures such as Moses Maimonides (whose influence is acknowledged by Nicholas) and Thomas Aquinas. The tradition would, in due course, exercise a profound influence on others such as Thomas Cajetan who, at the end of the 15th century, developed his highly detailed theory of analogy as a means of accounting for the fact that, despite the opaqueness of the transcendent reality, our language is not totally inadequate as a means of describing that reality.

The ignorance in question, one routinely acknowledged by men in the scholastic tradition, is of the transcendent God. But in a sense God is also immanent, and merely to know the world is to know him, for all existence comes from God, and in a sense is God's. Thus for all the emphasis the late Scholastics place on the otherness of God, they fully acknowledge that that otherness is only half the story; the other half is the being of God in the created order.

In the following century a major battle was fought by scholastic metaphysicians over the relation between God and his creatures, a battle in which 20th-century philosophers with 20th-century concerns are now greatly interested. The main protagonists were from the Iberian peninsula, not surprisingly since the Spanish and Portuguese universities remained bastions of scholastic philosophy throughout the century of the Reformation, producing such important scholastic thinkers as Francisco de Vitoria (*c.* 1483/6–1546), Domingo de Soto (*c.* 1494/5–1560), and Domingo Bañez (1528–1604), all of them Dominicans; and Francisco de Toledo (1532–96), Luis de Molina (1535–1600), Peter of Fonseca (1528–99), and the great metaphysician Francisco Suárez (1548–1617), who were all Jesuits.

The major battle in question, one which found Dominicans and Jesuits of Spain ranged against each other in the latter part of the 16th century, has an important metaphysical aspect, namely the existence of creaturely free will. The context of this metaphysical debate is, as usual with scholastic metaphysicians, theological. The Jesuit Luis de Molina employs the distinction between sufficient and efficacious grace. Sufficient grace is the grace by which a human agent has the power to perform a given act; efficacious grace is the grace by which the agent is empowered to perform a given act where in fact he does perform it. According to Molina there is no difference in essence between these different sorts of grace, the difference is in the outcome; efficacious grace is, crudely stated, sufficient grace where the agent in fact freely performs a salutary act. Molina's problem concerns how a free act of human will can exist given the all-encompassing scope of divine providence. Such providence seems to exclude the possibility of an efficacious grace simply because that grace involves the exercise of human free will. Molina's famous answer is that God has *scientia media* (middle knowledge), knowledge which is neither knowledge of how things are, nor of how they are not, but rather a knowledge of how they would be if other conditions were fulfilled. Thus God knows from all eternity whether a person would or would not freely perform a given act if he were empowered by grace to perform it.

Molina's chief opponent, however, the Dominican Domingo Bañez, objected that Molina has turned metaphysics upside-down, that he has started by assuming the existence of human freedom and has constructed a metaphysic of grace upon that assumption, whereas he ought to have started from the fact that efficacious grace is not merely sufficient grace plus the co-operation of the human will, but instead has a distinct essence. According to Bañez, efficacious grace is by itself, and without the co-operation of the human will, effective in securing the act foreseen by God when he gave the person the grace to perform it. Such grace, then, does not merely empower the agent, it impels him. Efficacious grace is thus in part a push (a 'premotion') which gets the agent going in the direction dictated by God's plan for the

universe. It is no wonder that Molina argued that Bañez's position was in effect a denial of the existence of human free will, as well as an affirmation that the evil in all evil human acts must be imputed to God. There are clearly a number of fundamental metaphysical issues involved here. One which has recently received close attention concerns the fact that Molina's concept of *scientia media* can be expounded in terms of a possible worlds semantics. That is to say, if God has *scientia media* then not only does he know every event that occurs in this world, but he also knows every event that occurs in every unactualized, though possible, world.

It is worth noting that Molinists were inclined to accuse Bañezians of Calvinism. This serves as a reminder that metaphysics, and even what might fairly be called scholastic metaphysics, was not solely the preserve of Catholic thinkers; Protestants, in particular Calvinists and Lutherans, also needed metaphysics, as much to defend themselves against each other as to defend themselves against the Jesuits. But to an overwhelming degree the major works of 16th-century scholastic metaphysics were written by Catholics, and certainly there is no Protestant work of that period to compare with such masterpieces as the *Metaphysicarum Disputationum* by Francisco Suárez with its immensely detailed analysis of the nature of being, the transcendental attributes of being, the principle of individuation, and other central metaphysical concepts.

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ALEXANDER BROADIE

Scholasticism, Post-Medieval II: 17th Century

Historical research into scholastic metaphysics in the 17th century is still in its embryonic stage. No reasonably complete bibliography of scholastic metaphysical texts exists for the period, and there is no general history of its development, except one-sided accounts of the metaphysical views of northern European Protestant Scholastics, the best account of which is contained in Max Wundt's book, *Die deutsche Schulmetaphysik des 17. Jahrhunderts* (Tübingen: Mohr, 1939). Still, although the golden age of modern scholastic metaphysics ended in the year 1617 with the death of Francis Suárez, what we do know concerning scholastic metaphysics of the 17th century indicates that there are philosophers in this tradition worthy of study in their own right. Further, these men were the teachers of René Descartes, Spinoza, Leibniz, and the great figures of the Enlightenment. These Scholastics are the bridge between the achievements of Iberian metaphysical speculation in the 16th century and modern metaphysicians. But there is yet another reason why this tradition should be of interest to the modern philosopher. No philosophical tradition of the modern age, other than that of the late 19th and 20th centuries which trains its members in the techniques of modern symbolic logic, contains better logicians than that of the Scholastics of the 16th and 17th centuries. As long as logic is the tool by which ontology is best investigated, one can expect interesting and fruitful discussion of its problems within this tradition.

The meaning of the term 'Scholasticism' is often unclear. As one studies scholastic philosophers, one is often surprised at the wide range of philosophical views they espouse. This problem is especially difficult when one considers how eclectic the early modern period was. Most philosophers were not hesitant to borrow views from the medieval scholastic tradition, or any other tradition for that matter, when doing so suited their purposes. We will therefore begin our investigation conservatively with the Catholic scholastic philosophers, and then proceed to

consider two groups which may be deemed scholastic in a broader sense: the Protestant and Cartesian Scholastics.

I will focus on a controversy which raged among 17th-century Scholastics: the controversy over the possibility of entities (*possibilitas rerum*), in order to present some examples of their metaphysical views. This controversy grows out of Francis Suárez's discussion of the distinction between existence and essence in *Disputationes Metaphysicae* 31. In this disputation, the old question again arises concerning the ontological status of the essence of, for example, Socrates before the individual Socrates comes into existence. Socrates's essence consists of his humanity and rationality, exactly all those things that make Socrates possible. Those acquainted with the secondary literature about Thomas Aquinas will note that the essences of creatures are called 'possibles' because the presence of such essences entails that the creature is a possible creature. Anything lacking such an essence would be impossible. Thus, a round square (philosophers of the time would call this impossible entity a 'chimera') would have no essence.

Catholic Scholastics were committed to reconciling Aristotelian metaphysical doctrines (usually as interpreted by the medieval scholastic tradition) with the revealed dogma of the Catholic Church. Perhaps the most striking aspect of Catholic Scholasticism of the 17th century is its variety. While the traditional schools of Thomism and Scotism were revitalized in the 16th century, the 17th century witnessed revivals of less well-known schools of medieval Scholasticism. Scholars began commenting on medieval Scholastics such as Henry of Ghent (*c.* 1217–93), John Baconthorp (died 1348), and Giles of Rome (*c.* 1243/7–1316) as a result of the renewal, and indeed the founding, of many Catholic orders during the Catholic Reformation. We may divide these Catholic Scholastics into four groups: the Thomists, the Scotists, the Suarezians, and a catch-all category for those who follow less well-known strains of medieval Scholasticism. Nominalism, except in so far as it is absorbed into the other schools such as the Suarezian, disappears, partially due to the Council of Trent's discomfort with that movement's views concerning divine grace.

The Thomists. These were generally found in the Dominican, Spanish 'barefoot' Carmelite, and Benedictine Orders during this period. The most conservative of these are the Dominicans and their close allies, the barefoot Carmelites. Their philosophical conservatism is so entrenched as to motivate them to defend old-fashioned medieval cosmology in the face of the successes of the new physics. Three important metaphysicians of this school were John of St. Thomas (1589–1644) and Anton Goudin (1639–95), both Dominicans, and the Carmelite Philippus a Sanctissima Trinitate (1603–71).

With regard to the possibility of entities, Philippus claimed that because faith holds that all (finite) beings were created in time, the essences of entities are not eternal, at least independently of God. Yes, he admitted, Socrates's humanity and animality are eternally capable of coming into existence as Socrates, but before Socrates exists, his humanity and animality are mere potencies, not in themselves, but only as they can be created by God. Thus, their possibility derives from God's power to create them. John of St. Thomas indicated that he was in general accord with Philippus since John said that God not only creates what is actual but also what has the potency to be actual.

Less conservative Thomists were the Benedictines. Among these were Saenz d'Aguirre (1630–99) at Salamanca, Coelestinus Sfondrati (1644–96) of St. Galli, and Ludwig Babenstuber (1660–1726) of Salzburg.

The Scotists. The Scotists of this period were very active. Their activity is due to the Franciscans' acceptance of Duns Scotus as their theological leader early in this century. As a result of this, Luke Wadding (1588–1657) began his famous edition of Scotus's *Opera Omnia*. Principal representatives of this school were John Punch (or Poncius) (*c.* 1599–1661), who helped Wadding edit Scotus's work, and Punch's rival Bartholomaeus Mastrius (1602–73), who wished to reconcile Scotus's philosophy with that of Thomas Aquinas.

John Punch's view concerning the possibility of entities was the object of attacks from

fellow Scotists (especially Mastrius) as well as from Thomists. Punch held that every created entity had some eternal being as the object of God's intellect. If created essences did not have such an eternal being in virtue of which they are said to be possible, then all creatures would be impossible. This eternal being which creatures have, Punch insisted, is neither a real being nor a mere being of reason (*ens rationis*). Beings of reason are beings which are conceivable, such as a round square, but which cannot exist. Clearly, Socrates' essence cannot be a being of reason. Otherwise, it would be impossible for Socrates to exist. On the other hand, Socrates's essence cannot be the real, actual individual Socrates because then there would be no difference between the non-existent, possible Socrates and the actual Socrates. Thus, the eternal being of Socrates is a 'diminished' being (*esse diminutum*) which is an intermediate type of being between real beings and beings of reason.

Mastrius, however, thought that this doctrine of diminished being was based on a misreading of Scotus. Mastrius held instead that the possibility of an entity was based upon a logical potency which the formal character of the possible entity has in itself quite independently of anything else, even God. A man, in so far as he is a man, and whether this is a real man or a man conceivable in the mind, is not opposed to existence. This lack of opposition (*non repugnantia*) to existence constitutes the logical potency of a man. Lack of opposition is not a mere negation or privation, however; it is something positive. This positive something is to be understood, Mastrius claimed, by means of a positive connection of terms expressed as a conditional. Thus, man is a logical possibility because *if* there existed a connection of animal with rational (the usual scholastic definition of 'man'), then no contradiction would follow.

The Suarezians. The Jesuits comprise the majority of Suarezians, that is, those who accepted many of the views of Francis Suárez. Chief among these are Petrus Hurtadus de Mendoza (1592–1651), who taught at Salamanca, Roderigo de Arriaga (1592–1667), who worked at Valladolid and Prague, and Francis Oviedo (1602–51).

Hurtadus held that the possibility of an entity is determined by God's omnipotence and his ability to create it. Arriaga thought, on the contrary, that we do not call an entity possible because God can bring it about. Instead, God can bring about the entity because it is in itself not opposed to existing. Arriaga agrees with Mastrius in expressing the possibility of an entity by the conditional: if such an entity existed, no contradiction would follow. Oviedo follows Arriaga's approach.

Others. Finally, there were several revivals of less influential medieval philosophical schools. The Servites in Italy followed Henry of Ghent. One finds among these interesting metaphysicians like Henricus Antonius Burgus (fl. 1627) and Angelus Ventura (fl. 1701). The calced Carmelites followed John Baconthorp. Their most important representative was the Spaniard Elisaeus Garcia (fl. 1701). Followers of the Augustinian Giles of Rome were also active during this century.

Garcia follows Baconthorp in holding that the possibilities of creatures are not simply derived from the omnipotence of God, nor are they a pure nothing, since 'nothing' expresses the negation of the total entity, including, it seems, its possibility. Possibilities have an objective being, which Garcia also calls diminished being, eternally as the objects of God's thought.

One aspect of 17th-century metaphysics requiring more research is the state of metaphysical studies among Catholic Scholastics outside Europe. Contrary to this trend, one finds the *Bibliography of the Philosophy in the Iberian Colonies of America* (The Hague: Martinus Nijhoff, 1972) by Walter Redmond. Redmond himself tells us that "the colonial period of Latin America is perhaps the least studied area in the history of western philosophy", and that the 17th century is the 'forgotten century' of Latin American philosophy.

The *Protestant Scholastics* were as heavily influenced by the work of Iberian Catholics like Suárez and Peter of Fonseca as the Catholics themselves. Their main metaphysical task was not to reconcile Aristotle with Catholic dogma, but to reconcile him with the truths revealed through their Protest-

ant faith. It is not surprising that they were less dependent on medieval Scholasticism, but in turn one must admit that there is less detailed and careful discussion of particular doctrines than one finds among the best Catholic writers. Here there were two general movements: the Reformed (Calvinists and Zwinglians) and the Lutheran. The Reformed philosophers absorbed Suárez's work earlier than the Lutherans, and, at least before the Thirty Years' War, enjoyed a lively period. Worth mention among these are Rudolphus Goclenius (Göckel) (1547–1628) and Clemens Timpler (1567–1624). Of the Lutherans, Cornelius Martini (1568–1621) and Jacob Martini (1570–1649) were very influential and substantial thinkers. From this branch grew a school of philosophers, who, independently of Descartes, became very interested in epistemology and had a great influence on philosophers of the early German Enlightenment. Among these Georg Gutke (1589–1634) and Abraham Calovius (Calov) should be listed.

Goclenius held that possibilities exist eternally as ideas in God's mind. Timpler thought that God's omnipotence was restricted to the non-contradictory since even God could not separate the humanity from Socrates.

The phrase *Cartesian Scholasticism* is not an oxymoron. Few scholars today would deny that many of Descartes's views were drawn from scholastic philosophy. Furthermore, several scholars of the 17th century were won over to Descartes's philosophy even though they also thought Scholasticism with its basis in Aristotle could be at least partially reconciled with Cartesianism. Preeminent among these scholars were Johannes Clauberg (1622–65), the eclectic Jesuit Jean-Baptiste Duhamel (1624–1706), the English Franciscan Anthony Legrand (died 1669), and Christian Thomasius (1655–1728). Thomasius and Clauberg provided models for the synthesis of Scholasticism and Cartesianism which ultimately guides the work of Leibniz.

Legrand borrowed Descartes's description of God as a king who has absolute dominion over not only what *is* but also what is *possible*. Essences are eternal and immutable only because God freely decreed that they are. It is possible, then, that God could have set up things differently and that, for example, triangles have four sides. Still, Legrand thought, a king can change his laws because his will can change. God's will is unchangeable and thus possibilities cannot be changed. Duhamel reveals his independence from Cartesianism by holding that the possibilities of entities stem primarily from the lack of opposition (*non repugnantia*) among the ideas of these entities. Their possibility cannot be derived from God's omnipotence since then the notion of omnipotence would be circular. Omnipotence is the ability, Duhamel said, to do or make anything which is possible.

Scholastic philosophy of the 17th century holds much of interest to the historian of philosophy. Besides the sophisticated treatments of the concept of possibility I have outlined, there are interesting discussions concerning universals, identity, freedom of the will, and God's foreknowledge, among many others. There is a further important reason for studying the Scholastics more closely. Until we have a better understanding of scholastic philosophy in the 17th century, any claim concerning the originality of the 'main' philosophical figures of the 17th and 18th centuries, such as Descartes, Spinoza, Leibniz, and Christian Wolff, must be viewed with suspicion.

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JEFFREY COOMBS

Scholasticism, Post-Medieval III: Protestant Scholasticism of the 18th Century

During the 17th century the German universities had experienced a revival of Aristotelianism. This phenomenon, which is known as *Deutscharistotelismus*, originated with the Lutheran theologians at a time when a philosophical differentiation inside the Protestant confession was taking place. Lutheran philosophers committed themselves to Aristotelianism all but dominated the universities in central Germany. The reformed philosophers (Calvinists, Zwinglians), on the other hand, impressed by Cartesianism and natural science, had moved to Holland. Though by the end of the century *Deutscharistotelismus* was on the decline, it nevertheless influenced the subsequent development of philosophy in Germany. This occurred not only in a negative way, via the critical rejection of Scholasticism which occurred at the beginning of the Enlightenment. Metaphysical and scholastic themes and questions survived also positively into the 18th century, thanks first of all to Leibniz and then later to Christian Wolff, who gave to the middle and late Enlightenment its characteristic metaphysical tone.

The German Enlightenment differs from contemporary movements in France and England also through its academic character. In the 18th century German philosophy is, with only a few exceptions – most importantly the movement of *Popularphilosophen* around the end of the century – associated with the universities. The systematic exposition that is an important characteristic of the philosophy of the German Enlightenment (and still appears in Kant's lectures) can be traced to the demands of philosophical teaching. According to the well-known definition given by Max Wundt (1879–1963): 'Protestant Scholasticism' in the 18th century means *Deutsche Schulphilosophie*.

Three main phases can be distinguished in the academic German philosophy of the 18th century. They are, in chronological order:

1. The early Enlightenment
2. Wolffianism and its first opponents
3. The decline of Wolffianism.

The Early Enlightenment. The beginning of the Enlightenment in Germany is characterized by a determined opposition to *Deutscharistotelismus*. The main figure in this movement is Christian Thomasius (1655–1728), who first taught in Leipzig and later in Halle and who held lectures in German. Having studied law, Thomasius displayed an eclectic, anti-authoritarian philosophical attitude which reflected the influence of Cartesian scientific circles and especially of Johann Christopher Sturm (1635–1703). When Wolff moved in 1706 to Halle, Thomasius's fame was on the decline.

Wolffianism and its First Opponents. The second phase is constituted by the dominance and diffusion of Wolffianism from approximately 1720 to 1750. Wolff's philosophy represents an integration of Catholic Scholasticism (mainly Thomas Aquinas and Francisco Suárez) and *Deutscharistotelismus* on the one hand with Cartesianism and Leibnizianism on the other. Wolff attempted to put the metaphysical ideas of the scholastic tradition into a strictly systematic form. Wolff's concept of system was to play an important part in German philosophy at least until the beginning of the 19th century. In addition he contributed substantially to a new appreciation of ontology as a basic philosophical discipline or *Grundwissenschaft*. In this respect his philosophy transmitted typical concepts of the scholastic metaphysical tradition to Kant and to idealism.

Wolff also elaborated a new concept of metaphysics: the latter is neither the union of ontology and natural theology (the view of *Deutscharistotelismus*), nor the union of natural theology and psychology (the view of the Cartesians). Rather, it represents a systematic framework constituted by the common principles of all these disciplines, including cosmology.

Ontology itself is, like the *metaphysica generalis* of the *Deutscharistotelians*, the doctrine of *ens qua ens*. At the same time it is also a science that includes all the principles of human knowledge, centred around the two highest principles of human reason, namely the principles of identity and of sufficient reason. Ontology begins with the explanation of these principles, which yield the founda-

tion for the system as a whole. This transition from ontology to logic has led some authors to associate Wolff's ontology with transcendental philosophy. Kant himself identifies transcendental philosophy as the "*System aller unserer reinen Erkenntnisse a priori*", where ontology is for him a "*Lehre von den Dingen überhaupt*".

Wolff's philosophy was embraced enthusiastically around the middle of the century. Before this triumph, however, Wolff had to neutralize the attacks of his first opponents. Thomasius's pupil Andreas Rüdiger (1673–1731) taught at the University of Halle. He propounded a philosophy of moderate sensualism and empiricism and criticized Wolff's mechanism and determinism. Philosophy, which deals with reality, has to be distinguished from mathematics, which deals with possibility. Philosophy should adopt the synthetic method, mathematics the analytic method.

Pietism, in order to combat the dominant Wolffianism, soon joins forces with the representatives of Thomasius's school. The ardent Pietist Joachim Lange (1670–1744) attacked Wolff's metaphysical principles as being deterministic and Spinozistic. The more independent Johann Franz Budde (1667–1729), who may be considered the father of the modern history of philosophy because of his great influence on the historian Jakob Brucker (1696–1770), fought Wolffianism from a complex eclectic point of view involving Cartesianism as well as elements of mysticism and cabbalism.

Although very different, all these philosophical conceptions have one common aspect: the rejection of Aristotelianism in its traditional scholastic form, as well as in the new form given to it by Wolff.

Decline of Wolffianism. This third phase is represented by opponents of Wolffianism of the second Pietistic generation. The main figure in this movement is undoubtedly the Leipzig philosopher and theologian Christian August Crusius. Crusius did not take part directly in the Pietists' fundamental opposition to metaphysics and systematic philosophy. Consequently he did not try to fight Wolffianism simply by disputing controversial points, but rather by presenting a philosophical system of his own.

Crusius used empiristic and sensualistic elements from Thomasius's school; with Rüdiger he emphasized the relation of philosophy to reality and accordingly the ontological priority of reality over possibility. Crusius also called into question the applicability of the mathematical method to philosophy as well as the general validity of the principle of sufficient reason. The latter involves a mechanistic determinism that overrules human freedom and morality. These reflections, embracing also the problem of the bounds of the human intellect and the priority of will over intellect, had a considerable influence on Kant's precritical thought. Crusius's philosophy was very successful in university circles as an alternative to Wolffianism and represented the last important academic philosophy before the Kantian era.

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SONIA CARBONCINI

Scholz, Heinrich

Heinrich Scholz (1884–1956) is one of the outstanding German scholars of the 20th century. After studies in theology (under Adolf von Harnack, 1851–1930) and philosophy (under Alois Riehl, 1844–1924), he served as professor at Breslau (1917–19), Kiel (1919–28), and Münster (1928–56). His chair at Münster was originally in philosophy, but was changed into the first German professorship in 'mathematische Logik und Grundlagenforschung' in 1943.

Scholz enriched three different fields with his research: theology, philosophy, and symbolic logic. *Theology* is indebted to Scholz for important contributions to the interpretation of Friedrich Schleiermacher (1768–1834) and to the discussion of scientific method in theology. His *Religionsphilosophie* (1921) set in its revised edition (1922) a new standard of discussion within the field of philosophy of religion both in content and in methodology. It was the first German 'analytical' philosophy of religion. Scholz identifies two crucial questions for philosophy of religion: whether the proposition 'God exists' is true and whether religious experience is possible.

Philosophy is indebted to Scholz for his work on the history of the axiomatic-deductive method and for his historical-systematic reconstruction of the concept of metaphysics. Scholz's research in *symbolic logic* is summed up in his massive posthumous work *Grundzüge der mathematischen Logik* (1961), which is based on a Platonic ontology. Here Scholz insists on the precise distinction between merely syntactically arranged calculi, for which Scholz introduces the term "Zeichenspiele" (game of signs), and "calculi of logic" as semantically interpreted calculi in which logical truth is defined as "validity in all possible worlds". The semantic interpretation is given with reference to the work of Alfred Tarski.

The thinking of Scholz is centred around the crucial philosophical question of metaphysics: is metaphysics possible in the modern age? Here Scholz saw symbolic logic as playing an important role and gave this field increasing attention from 1921 on. He did not agree with Rudolf Carnap and the Vienna Circle that symbolic logic would destroy metaphysics. Rather, he saw it as the culmination of the tradition of Western metaphysics and he attempted to demonstrate this systematically in his *Geschichte der Logik* (1931).

He analyses the traditional concept of metaphysics set out by Aristotle and Leibniz and shows how this concept was modified by René Descartes and especially by Kant. As a result of these analyses Scholz defines metaphysics as "*Grundlagenforschung*", a term perhaps best translated as 'research into the fundamental structures of reality'. Scholz held, in agreement with Leibniz, that this research must be formalized. Precisely this concept of Aristotelian-Leibnizian metaphysics came to realization, according to Scholz, in the work of Bernard Bolzano, Gottlob Frege, and Bertrand Russell. Scholz understands his own work within this tradition and shows how symbolic logic and metaphysics can be combined into "*formalisierte Grundlagenforschung*" in his book *Metaphysik als strenge Wissenschaft* (1941).

He illustrates what he means by presenting especially a formalized theory of identity. As a complement to this formalization of metaphysics, Scholz urges also an ontological interpretation of logic. According to Scholz, the axioms of logic are properly understood only if they are interpreted as expressing fundamental laws of being. The ultimate question whether we know the *truth* of these axioms Scholz answers with reference to the Augustinian-Leibnizian notion of 'illumination' (see e.g. Leibniz, *Philosophische Schriften*, ed. Gerhardt, vol. 7, p. 111). In this categorically different but nevertheless indispensable new type of metaphysics one can no longer speak in the mode of *Wissen* (knowledge) but only in the mode of *Glauben* (faith): a personal 'statement of faith' is the only adequate form of speech.

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EBERHARD STOCK

Schopenhauer, Arthur

The main work of Arthur Schopenhauer (1788–1860) was *The World as Will and Representation*, first published in 1818 in one volume, later published with an additional volume of supplementary chapters. Important supplements to this are: *On the Fourfold*

Root of the Principle of Sufficient Reason (1813), *On the Basis of Morality* (1841), and *On the Freedom of the Will* (1841).

Schopenhauer adopts Kant's transcendental idealism on a similar, but simplified, basis. The ordinary natural world has a merely phenomenal existence, that is, it only exists for the actual and possible perception of observing minds such as ours. This, as with Kant, alone explains the fact of our *a priori* knowledge of the space and time in which all natural things exist, and of the law of causality under which all events must fall. In developing this theme Schopenhauer argues that the different forms of the *a priori* are specifications of one basic principle, that of *sufficient reason*, according to which there must be a reason for everything. There are four such specifications:

1. *The principle of the sufficient reason of knowing*, which says that every proposition which is to be accepted as true must have some type of justification or proof.
2. *The principle of the sufficient reason of becoming*, or *law of causality*, which says that every event must be determined according to some causal law by previous events. This is the guiding principle of natural science.
3. *The principle of sufficient reason of being* says that the character of every part of space is determined by its relation to other parts of space, and of every moment of time by its relation to other moments of time. The full articulation of this principle consists in Euclidean geometry, which characterizes spatial relationship; and arithmetic, which characterizes temporal relationship (in virtue of the temporal nature of counting).
4. *The principle of the sufficient reason of action* or *law of motivation* which says that every human action must have had its motive and which underlies all understanding of human behaviour at the phenomenal level.

Of these 2., 3., and 4. draw attention to pervasive facts about the world our *a priori* knowledge of which can be explained only as the self-knowledge we have of the way in which we ourselves construct it. It follows that the world only exists for minds such as ours. Thus 3. is really the knowledge we have of our own *sensibility* and 2. the knowledge we have of our *understanding* (= the propensity to make causal inferences). Principle 1., however, does not concern the character of the phenomenal world but articulates the manner in which we are bound to organize our thoughts about it when we reflect on it in conceptual thought. This is the activity of *reason* which separates man from animals. It is less fundamental than *understanding* which we have in common with them, and which gives us our basic awareness of the physical world. For this is the object of a causal hypothesis concerning the causation of our sensations, developed under the guidance of the *a priori* representations of space and time supplied by sensibility. The sum of all four principles is that there can be no object without a subject and that to know the general nature of objects and to know the general nature of the subject are in the end the same.

But though the natural world is no more than an object for a subject, without independent existence, it must be the appearance to him of something which exists, so to speak, on its own bottom. This is the inevitable *thing in itself*, the true nature of which Kant has said knowledge, as opposed perhaps to faith, can never grasp. Schopenhauer's distinctive metaphysical position turns on his hypothesis that something of its nature is, after all, available to metaphysical knowledge. The clue to it lies in the one case in which each of us does have direct knowledge of a thing in itself, namely his own will, which he can recognize as being that of which his bodily behaviour and form is the phenomenal appearance (and of which the consciousness which constructs the objective world is but an accident). Reflection shows that the inner core of all other things must similarly be will, indeed the same one cosmic will, since there can be but one thing-in-itself. For *number* applies only to objects in space and time, and these are merely phenomenal (the oneness of the thing in itself is not a number but the

negation of plurality). Any doubts on this score can be laid to rest by reflection on nature as it presents itself empirically. For all its phenomena suggest endless restless striving.

So the reality behind nature is a single will, a kind of mostly unconscious futile yearning, of which all natural phenomena, including ourselves, are in their true being but aspects. However, it evidently 'objectifies' itself at different levels, as for instance in the inorganic, in plants, in animals, and in humans. (There seems to be an ambiguity to Schopenhauer's notion of will objectifying itself; it should refer simply to its appearance to a consciousness, but it sometimes seems to imply a more real way in which the will realizes itself within phenomena.) These different levels must somehow express different grades of willing within the one will, and the common grades to which all phenomena of a single type belong are the same as Plato's forms, properly understood.

It is evident *a priori* that the one cosmic will which manifests itself to itself as the phenomenal world must be wretched. For will is of its nature unsatisfiable. The empirical nature of the world fully bears this out *a posteriori*. But some kind of salvation is possible for man and through him for the universe as a whole. A temporary haven from misery is provided by aesthetic experience, when the will suspends its frenetic activity to contemplate the Platonic form (i.e. particular grade of will) manifesting itself in something perceived. More complete is the self-denial of the saint. These fragmentary self-denials of the will in different persons (each in itself a distinct form, or grade of the one will, governed by a distinctive law of motivation freely chosen at the noumenal level) may be the harbinger of some final self-denial of the will at large, 'after' which it will no longer manifest itself to itself as a phenomenal world. Then there will be nothing, or at least nothing of which we can conceive, neither nature nor will (since what was *will* will have ceased its willing). However, so Schopenhauer darkly hints, what is *nothing* so far as we are concerned may in its own terms be a *something*, a something mystics may experience and which may finally rectify the mistake it made in becoming will. (Of course, the use of tenses here can only depict some deeper nontemporal contrast between the will asserted and the will denied.) Schopenhauer, we may note finally, relished aspects of Hindu and Buddhist thought as corresponding to an outlook he had developed through personal experience and through his reflections on Plato and Kant.

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TIMOTHY L. S. SPRIGGE

Schröder, Ernst. See: Boolean Algebra

Schütz, Alfred

The work of Alfred Schütz (1899–1959) was the main inspiration for the development of phenomenological sociology. In the period since his premature death, his influence has continued to increase. His work has influenced recent discussion in ethnomethodology (see Harold Garfinkel, *Ethnomethodology*, 1967; Erving Goffman, *Frame Analysis. An Essay on the Organization of Experience*, 1986). Phenomenology in America took root in the work of Marvin Farber (1901–80) and Dorion Cairns (1901–73). Together with other refugee phenomenologists from Europe such as Felix Kaufmann (1895–1949), Fritz Kaufmann, Aron Gurwitsch (1901–73), and Helmut Kuhn, Schütz was important in further developing the phenomenological impulse in the United States. Schütz, more than anyone else, extended Edmund Husserl's phenomenological thought to the social world. But his thought is important in itself, as an original attempt in the study of social phenomena, and as an approach to developing the philosophical foundations of Max Weber's (1864–1920) sociology.

Schütz was born in Vienna, and studied law, economics, philosophy and social sciences there with Ludwig von Mises (1881–1973), Othmar Spann (1878–1950), Hans Kelsen (1881–1973), Friedrich von Wieser (1851–1926), and others. He was introduced to Husserl in 1932, and maintained close contact until Husserl died. Schütz left Austria because of the Nazis. He spent a year in Paris before emigrating to the United States, where he was active in law and banking, and where he taught and wrote until the end of his life. The American phase of his career provided a useful encounter with American pragmatism, including the thought of G. H. Mead (1863–1931) and above all William James.

Schütz's wide learning has meant that commentators often try to locate him with respect to others' views, which he is said to bring together or even to synthesize. Although useful, this type of approach tends to obscure the originality of his thought. For instance, the frequent claim that in his first book (*Der sinnhafte Aufbau der sozialen Welt*, Vienna, 1932, translated as *The Phenomenology of the Social World*), Schütz attempted to bring together Husserl and Weber is probably neither true nor false, since it suggests a simple eclecticism in his position.

Schütz's view has been called a phenomenology of the natural attitude and the Husserlian term "natural attitude" provides a clue to Schütz's deep, but also critical, relation to Husserl. It has been said that more than anyone else he carried the authentic impulse of Husserl's thought to the realm of daily life, including its essential structure. With the possible exception of Ludwig Wittgenstein, Schütz is arguably the first thinker to understand the paramount reality of commonsense life, which is a synonym for Husserl's "life-world". In his last, unfinished treatise, *The Crisis of the European Sciences and Transcendental Phenomenology*, Husserl employs this concept to focus on the phenomenon of the world. In Husserl's last work, "life-world" refers to the world in which we are immersed in the natural attitude, which is never an object as such, which is the pre-given basis of all experience, and which is the presupposition of all science.

Schütz attempts a systematic description of the eidetic structure of the life-world. His intention is arguably to undercut the traditional barrier between philosophy and social science by reviewing the phenomena dealt with in the social sciences in a deeper manner. In his writings, phenomenology integrates analyses of concrete phenomena in a wide variety of fields, such as sociology, social psychology, economics, history, political theory, jurisprudence, etc. Schütz provides detailed discussion of the commonsense and scientific interpretations of human action as well as detailed treatment of concept and theory formation in the social sciences. Following Husserl, he insists on the rootedness of scientific conceptions in the everyday world.

In his writings, Schütz analyses various themes. In his first book, the only book published during his lifetime, his study of the philosophical foundations of Weber's sociology used Bergsonian and particularly Husserlian categories to explore the temporal constitution of social action and to analyse our understanding of other people. But he differs from Husserl in his transition from the ego in the world. In his analysis of the multiple realities, or of the worlds in which we are embedded, he leans particularly on James, with emphasis on the world of working as the paramount sub-universe of reality. But Schütz departs from James in holding that the multiple realities are provinces of meaning and not of sub-universes, since it is the meaning of our experiences, and not the ontological structure of objects, which constitutes reality. This change has important consequences for the theory of knowledge. It has been said that in this way he effects a transition from perception to action as the basic epistemological concept.

In his theory of meaning, Schütz relies on Husserl, but shifts the analysis from the logical sphere to the social plane. Here he introduces a series of useful distinctions between social ambiance (*Umwelt*), the social environment (*Mitwelt*), and the social world (*Vorwelt*) of our ancestors (*Vorfahren*) and successors (*Nachfahren*). The limits of individual action are set by a nature and society which the individual did not make, but to

which it belongs and which constitutes its biographical framework. Schütz believes that the individual grasps the actuality of ordinary life through the typification of daily, taken for granted, being with others. For this reason, it has been suggested that anonymity is a transcendental clue to the understanding of his view of the social world. Schütz holds that the social world is the home of anonymity and anonymization, which refers to the typified structures of the objective aspect of the social world, that is, the series of interlocking meanings which enable the individual to function in the world of working and to find his way in other spheres of meaning.

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THOMAS ROCKMORE

Scotism

Scotism, the philosophical and theological heritage of the Franciscan John Duns Scotus (*c.* 1265–1308), represented one of the three major trends of scholastic philosophical theology, the first being that of Thomism, and the last that of nominalism, inspired by another Franciscan, William Ockham. The mendicant orders founded by St. Dominic and St. Francis of Assisi initially supplied the majority of shining lights at the University of Paris and its rival at Oxford. While the Dominicans by the end of the 13th century had officially adopted Thomas Aquinas as their 'Common Doctor', the Franciscans, with so many prominent theologians, including Alexander of Hales (*c.* 1185–1245), St. Bonaventure (1221–74), and Scotus himself, were not so quick to choose a single doctor for their order. Scotus, however, despite his relatively short life and the unfinished state of most of his writings, had introduced so many seminal ideas into the scholasticism of his day as to permanently change its character. If his philosophical insights and theological positions were not always fully accepted, they were often either partially modified or became the target for special constructive criticism by subsequent theologians, both outside and especially inside the Franciscan Order. For Scotus's gift for synthesis had enabled him to bring the Augustinian insights admired by earlier Franciscan thinkers into the mainstream of scholasticism and his following quickly grew into a distinct school of thought.

But it was only several centuries later, in 1633, that the Franciscan Order confirmed and adopted Scotism officially. The result was a vigorous impulse to Scotistic studies, stimulated by Luke Wadding's *Opera omnia* edition of 1639. This gave rise to the golden age of Scotism between the 16th and 18th centuries, when Scotistic chairs were established in the principal universities of Europe. So popular had the school become that the Cistercian moral theologian John Caramuel at Louvain, writing in the mid-17th century, was able to declare that "the school of Scotus is more numerous than all the others combined". But this widespread acceptance of his philosophy also made it the special butt of criticism, either for those who rejected its orthodoxy, like the reformers, or for those who deplored its subtleties, like the humanists, who coined the term 'dunce' for those Scotists insensitive to the merits of the new learning.

With the decline of scholasticism in general in the 18th century, augmented by the suppression of religious orders in many European countries, interest in Scotus waned. Nevertheless, Scotism was taken seriously and was an influential factor in the thinking of men like Galileo, René Descartes, and Leibniz, and indeed of C. S. Peirce, who declared

that "Duns Scotus and William Ockham are decidedly the greatest speculative minds of the Middle Ages as well as two of the profoundest metaphysicians that ever lived".

Characteristic of Scotism, as contrasted with other forms of scholasticism, are the following. Metaphysics is the science of being *qua* being, where being is a simple substantive notion univocally predicable of God and creatures, substance and accident. One of the primary goals of metaphysics is to use the transcendental properties of being to prove the existence of one being infinite in perfection as the necessary condition for the possibility of any finite being. Scotus himself showed in a most ingenious and elaborate way how such a proof could be constructed so as to meet the technical requirements of an Aristotelian demonstration. Scotist theologians continued to present this proof as the philosophical interpretation of what God meant when he revealed his name to Moses as 'I am'. Like Scotus, they stressed particularly that, since contingency cannot be derived from necessity and is an empirical datum, God must have created the cosmos by a free and generous act of his will. Hence those philosophers, like the Averroists, who viewed creation as a necessary emanation from the Creator, were clearly in error.

In contrast to nominalism, Scotists maintained that to each correct formally distinct notion of any real thing there corresponds some isomorphic reality, called technically a 'formality' or *ratio realis*. If such a notion is substantive (i.e., descriptive of that thing's real essence), the corresponding formality is known as its '*common* nature', since the nature in this individual is isomorphic with the natures of other individuals of the same species. In addition to its nature each thing has some additional unique positive entity that individuates it, called for want of any descriptive term its 'haecceity' (thisness). A formal distinction exists between a real thing's common nature and its haecceity. Because formalities are not separable from one another in the thing itself, but are only separated conceptually in the rational mind, Scotus declared the formal distinction could also be called 'rational', provided each *ratio* it distinguishes is understood to be a characteristic of the real thing rather than just a concept created by the mind. The distinction could also be called 'virtual' inasmuch as each extramental *ratio* has the virtue of producing a distinct concept of itself in the intellect. This is in essence the meaning of 'Scotistic realism'.

Besides its recognized power of abstracting such general descriptions of things, the intellect also has some direct intuitive knowledge of existents, such as a person's cognitive states, affections, and volitions. But it has no direct intuitive knowledge of any substance, whether material or spiritual.

The will guided by right reason is the most God-like of human powers. We have a moral obligation to use it properly, that is to say: to love God as our supreme good and ultimate end, and secondarily to love self and other persons in an orderly and balanced way. Since this secondary obligation is both multiple and complex, conflicts of interest can arise, and in certain cases God can reasonably dispense one from a lesser obligation of the natural law to prevent one violating a higher one. However, God can never dispense man from his primary obligation to love and reverence God. The theory of 'haecceity' invests each individual, and especially each person, with a unique value in the eyes of God. Hence, Scotists regarded all creation with reverence, and it is not surprising that they held a populist interpretation of political authority in contrast both to the monarchism of Dante and the absolutism sired largely in Scotus's own day by Philip the Fair of France.

Scotists were also the principal university defenders of these following controversial tenets. Prime matter as the basic essential constituent of bodies is not sheer potency, but has some actuality of its own apart from what it receives from its substantial forms. Living bodies, in addition to the form of the soul, the principle of life, have a *forma corporeitatis* that gives them structure or organization. Other distinctive Scotistic doctrines are: theology is essentially a practical rather than a speculative science; charity rather than wisdom is the supreme virtue; the motive of Christ's incarnation was not primarily redemptive, and Mary his immaculate

mother never contracted original sin. (These last two were especially marks of difference between the Scotists and Thomists.)

Later Thomists and even nominalists often unwittingly adopted with subtle changes elements of Scotism. What V. J. Bourke said in his historico-critical survey, *The Will in Western Thought* (1964), holds for other key ideas of Scotus as well:

> The view of Thomas Aquinas that will is a rational appetite with some necessary activities and some free ones, drops out of sight and is replaced (during the fourteenth century down to the present day, in most writings by Catholic philosophers and theologians) by a theory of 'free will' which is basically Scotistic . . . In most practical details this theory does not differ essentially from the view commonly held by the Schoolmen. The only thing that needs to be added is that practically all of the Schoolmen are under the impression that they are teaching Aquinas' theory of will.

Since the Wadding edition included several inauthentic works, controversies arose as to what Scotus really held. Thus he was credited with Avicebron's (Ibn Gabirol) conception of matter and Vital du Four's theory of an intellectual intuition of individual material objects. To correct such misconceptions, the Scotistic Commission under Carl Balić began in 1950 the critical Vatican edition of Scotus's *Opera omnia* that is still in progress.

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ALLAN B. WOLTER

Second Intentions

The term 'intention' is most likely a medieval rendering of Avicenna's technical term '*ma'na*' (cf. Gyekye 1971), a term which he developed to designate 'conceptual' forms, as opposed to the more familiar 'Forms in themselves' of Plato and the 'forms in individuals' of Aristotle (cf. Kneale and Kneale 1962). '*Intentio*', '*attentio*', and '*conceptus*' are virtual synonyms in the logical literature of medieval and late scholasticism (see Hickman 1980).

G. Harderwych, in the 15th century, in his *Commentaria in Isagoges Porphyrii* (1494) noted three senses of the term 'intention':

1. an act of intending,
2. the thing which is intended (or attended to), and
3. that by means of which something is intended.

Put in contemporary terms, sense 1. would be the concern of psychology, sense 2. the concern of epistemology, and sense 3., as what is capable serving as a term of a proposition, the province of logic. Harderwych's distinction bears a close resemblance to what Karl Popper has termed his worlds two, one and three, respectively.

Another late scholastic, Francisco Suárez (*Disputationes Metaphysicae*), collapsed Harderwych's senses 2. and 3., which he then termed 'objective' concepts or intentions, and opposed them to sense 1., which he called 'formal' concepts or intentions. This distinction between 'objective' and 'formal' intentions was also maintained by Gottlob Frege in his *Foundations of Arithmetic* (see Angelelli 1967).

For both Suárez and Frege, only objective intentions or concepts are the proper concern of logical theory, whereas formal intentions are identified with real mental activities.

To characterize this latter distinction more precisely, formal intentions may be said to be real psychological occurrences in the intellect; they have temporal duration, and are characterizable as acts, images, similitudes, or ideas. Objective meanings or intentions are neither spatially nor (necessarily) temporally located, but are intended or understood by such mental acts. They are the 'places' where those mental acts 'terminate' or come to rest. A recognizable version of this distinction was articulated by William James in his *Principles of Psychology* (1950, p. 243), where he wrote of the "resting places" of thought, which he called its "substantive parts", and of its "places of flight", which he called its "transitive parts".

In addition to being 'formal' or 'objective', intentions were also said to be either 'first' or 'second'. For some scholastic followers of Thomas Aquinas (see R. Schmidt 1966), among them J. Sanchez Sedegno (see *Quaestiones* . . . 1616), John of St. Thomas (1589–1644), and Domingo de Soto, first intentions were generally said to be '*entia realia*', or to have real being. This position was an attempt to be true to Aristotle's 'mirror' theory of perception, in which the form or similitude of an object was captured in or reflected by the mind. First intentions, such as the referent of 'man' in 'Socrates is a man', were said to be *entia realia* because they are as they are by virtue of the conceived entity alone, without respect to any modification on the part of the intellect. This Thomist position was thus a variety of epistemological realism.

For some followers of John Duns Scotus, however, such as C. Sarnanus (died 1595) (see A. Gothutius, ed., *Gymnasium Speculativum*, 1607), first intentions were said to be *entia rationis*, or beings of reason. They argued that even in conceptualization of the most basic type there must be present some constitutive activity of the intellect, setting things in an order which makes them available to it. For the Scotists, then, first intentions are as they are only 'thanks to the intellect', and 'concepts' are so called because they are the 'children' of the intellect.

Still other scholastics, such as William Ockham in his *Summa Logicae* in the 14th century and John Major (*Summule Maioris Nunquam* . . .) at the beginning of the 16th, largely ignored objective intentions, thought the distinction between *entia realia* and *entia rationis* superfluous, and argued that first intentions are mental terms which stand naturally for the things they signify, provided that those *significata* are not themselves signs. First intentions in this sense are mental signs, as distinguished from written signs and spoken signs, which are said to stand only conventionally for their *significata*. Since mental signs may either be interpreted as mental acts or similitudes, on the one side, or as terms of a mental grammar, on the other, Ockham's position remained somewhat ambiguous from the viewpoint of the objectivists.

Whereas the objectivists held different views regarding the nature of first intentions, they held quite similar views regarding second intentions. For both Thomists and Scotists, second intentions were *entia rationis*, beings of reason, as opposed to real beings. Beings of reason were said to be divided into three types: privations, such as blindness; negations, such as chimerae and squared circles; and relations of reason. Logical second intentions were defined as relations of reason whose foundations are first intentions. Thus the second intention 'species', for example, was identified by most Scotists and Thomists alike as the name of a relation of reason which arises when the intellect relates a class to an individual which is an element of it. The relation between 'man' and 'Socrates' in 'Socrates is a man' may thus have as its foundation a real physical or metaphysical relation (*in causando* or *in essendo*), but *qua* logical, it is a relation of reason. Most objectivists were also careful to acknowledge the difference between a relation of reason and its converse. The second intention 'individual', the relation of reason between 'Socrates' and 'man' in the preceding example, was taken as the converse of 'species', another second intention which is the relation of reason between 'man' and 'Socrates'.

The objectivists also characterized second intentions as properties of higher levels. J. Sanchez Sedegno, for example, defined second intentions in the following way: 'A second intention is a property (*proprietas*) belonging to things from the being which they have in the intellect'. A remark by John of St. Thomas in this connection tells us why there were for the objectivists no 'third' intentions, as there are for us today properties of the 'third' level. "The reason", he wrote, "why some intentions are called *second* . . . is that they are connected with a second state of the object." For John the function of logic is to arrange things in so far as they exist in knowledge, and properties of levels 2 through *n* are thus all 'second', because of their 'being in apprehension'.

In his *Summa Logicae*, William Ockham generally treated second intentions as natural concepts of first intentions, that is, as mental

signs of signs which are not themselves signs of other signs. Even though Ockham most often identified these mental signs with mental acts or similitudes, his position admitted sufficient ambiguity to allow John Major and his students at the University of Paris, 150 years later, to interpret him as having emphasized the grammatical characteristics of second intentions. Their view, like that of Ockham, was that a second intention "is a term which signifies a thing which is a sign by virtue of that principle according to which it (the sign) is significant". But whereas Ockham's primary examples of second intentions had included 'genus' and 'species', Major's examples of second intentions are almost entirely grammatical ones such as 'name' and 'adverb'. By the time of Thomas Hobbes, nominalists were treating second intentions as 'names of names and speeches'.

The nominalist doctrine of first and second intentions was, then, a part of a philosophy of logic which was at first psychologistic, but later placed its emphasis on predication in the grammatical sense and looked to Aristotle's *Topics* for inspiration. First and second intentions were for the objectivists a part of a logical theory which emphasized an aspect of predication closer to that of Aristotle in the *Categories*, and to what we today know as predication theory in the Fregean sense and as naïve set theory.

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LARRY HICKMAN

Segelberg, Ivar

Ivar Segelberg was born in Sweden in 1914. He studied philosophy at Uppsala University and was appointed in 1951 to the chair of theoretical philosophy at Gothenburg University. There he was the centre of a productive group composed of students and former students, including the logician Per Lindström. Under Segelberg's leadership, the Gothenburg department focused on analytic ontology and phenomenology. This was unique in Sweden, where logic, philosophy of science, and social ethics were the primary interests in other philosophy departments. Segelberg died in Gothenburg in 1987.

Segelberg was one of the first philosophers to combine basic themes from the phenomenological tradition of Edmund Husserl and the British analytic tradition. Much of his writing consists of critical analyses of works of C. D. Broad (1887–1971) and Husserl that are developed into alternative solutions to the problems they addressed. To a lesser extent, G. E. Moore, the Swedish philosopher Adolph Phalén (1884–1931), J. M. E. McTaggart, and G. F. Stout played a similar role in Segelberg's work. His first book, *Zeno's Paradoxes*, was subtitled 'A phenomenological study', by which Segelberg meant an ontological study in the sense of Alexius Meinong's theory of objects. In that book and in his later books, Segelberg focused on the analysis of various kinds of complex entities and on the relations they had to each other and to their elements. Thus, he discussed various relations between wholes and parts, including those between a set and its elements, an object and its qualities, a spatial or temporal extent and its parts, a mental act and its constituents.

One distinction he took to be fundamental was that between a collection and a complex unity. A collection is not a set, since (1) a collection contains at least two disparate elements, (2) an object contains a collection if and only if it contains the elements of a collection, and (3) the statement that an object contains a collection is logically equivalent to a statement asserting that the object contains all the elements of the collection. A complex unity is a complex object where the last condition does not apply: thus a complex unity depends upon the elements of the complex being connected. Segelberg also insists on distinguishing a complex unity from

the fact that the elements of it are related in a certain way. Thus, in the case of a rectangle r composed of two squares a and b, he distinguishes r which is a complex unity, the set whose elements are a and b, the collection of a and b, and the fact that a and b are spatially adjacent. Such distinctions, and the various senses of 'part', 'whole', 'element', and 'contain' that they entail, as well as further distinctions concerning the area, the extension, and the boundary of r, supply a basis for his attempt to resolve Zeno's various paradoxes. His discussions of these paradoxes involve analyses applying these concepts to questions about temporal instants and duration.

In two later books, *The Concept of Property* of 1947 and *Studies of Consciousness and the Concept of Self* of 1953, he modified and applied the conceptual apparatus introduced in *Zeno's Paradoxes* to the problems posed by predication, the realism–nominalism issue, perception, intentionality and mental acts, and the nature of material objects and the self. Taking quality instances (moments) and primitive universal relations as basic entities, he attempts to show how mental acts, material objects, selves, facts, temporal continuants, etc. can either be construed as existent complexes or rejected as fictions. His analyses and his use of quality instances bear a noteworthy resemblance to Nelson Goodman's use of qualia in the latter's *The Structure of Appearance* of 1951.

Though he borrowed themes and terminology from both Edmund Husserl and the British analytic tradition, Segelberg's analyses are often original and bold. Yet, his analysis of predication is incomplete, given his acceptance of universal relations along with his nominalistic assay of monadic qualities as quality instances. Nevertheless, his attempt to work out a nominalistic assay of monadic predication is one of the most detailed and carefully argued in recent philosophical literature, and in his three short books Segelberg presented a comprehensive metaphysics directed at a number of fundamental and perennial problems in ontology.

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HERBERT HOCHBERG

Sellars, Wilfrid

The American philosopher Wilfrid Sellars (1912–89), son of Roy Wood Sellars, taught at Minnesota, Yale, and Pittsburgh; he ranks with the most important representatives of analytical philosophy. Sellars's philosophy is expounded in a large number of interrelated papers on widely diverse systematic and historical topics. Twice he devised a synoptic presentation of his philosophical scheme (Sellars 1968, 1979). The main thrust of his philosophical investigations is, uniquely in contemporary philosophy, to elaborate a *consistently nominalist-naturalist system*. Sellars's approach, which is historically indebted to Kant, Charles S. Peirce, and the early and late Ludwig Wittgenstein, synthesizes 'coherential/idealist' and 'correspondential/realist' elements. On the one hand, Sellars developed a functionalist theory of meaning and truth and assigns normativity a constitutive role in scientific theory construction; this part of his thinking initiated the influential movement of 'social pragmatism'. On the other hand, Sellars maintained a naturalist account of linguistic representation which is interconnected with a quasi-behaviourist philosophy of mind and embedded in a scientific-realist metaphysics. However, the different strands of Sellars's thinking not only synthesize but also side-step established dichotomies and thus elude a precise classification in terms of familiar oppositions.

Unlike other contemporary nominalists, Sellars does not engage in devising formal systems with restricted quantification. In his view W. V. O. Quine's quantificational criterion for ontological commitments capitalizes on one particular reading of quantificational contexts in natural language. Sellars rejects this reading and opts for a specific variety of the substitutional account of quantification. (1963, Chapter 8; 1979, Chapter 1). Sellars's

nominalism consists in the much more comprehensive claim that one does not need to commit oneself to abstract entities in developing

1. a semantics of 'abstract expressions' like 'redness', 'symmetry', 'that Bob is tall';
2. an interpretation of mentalist discourse;
3. a theory of predication;
4. an ontological scheme of basic entities.

Ad 1. Interlinguistic meaning ascriptions such as

(i) 'rot' (in German) means red,

characterize foreign expressions in terms of their functions, indicated by indigenous expressions. Drawing support from this observation, Sellars develops a non-relational, functionalist model of semantics which equates the meaning (sense or reference) of an expression with its function or role within a 'language game', i.e., the web of social practices of the relevant linguistic community. A speaker can state a linguistic function either explicitly, as a set of rules governing the use of an expression, or illustratively, by mentioning an expression in a way that highlights its function. According to Sellars's analysis, all semantic relations express functional classifications along these lines; like sentence (i) above, sentence

(ii) 'rot' stands for redness

classifies tokens of 'rot' as tokens of the type of linguistic function that is illustrated by 'red' and should therefore read

(iii) 'rot's are ·red·s

(with the dot-quotes indicating functional quotation). Thus, abstract terms ('*F*-ness', 'that *p*') reveal themselves to be nothing other than explicit functional quotation contexts, operating with functional quotation marks like '. . . ness' or 'that . . .'. On this interpretation abstract terms appear as metalinguistic illustrative expressions for *kinds* of linguistic functions; as kind terms they can be taken to refer distributively to their members, namely, to all expressions of different languages that have (in the language to which they belong) the same function as the quoted *L*-expression has in *L* (Sellars 1963, Chapter 11; 1967, Chapter 3; 1979, Chapter 4).

Ad 2. In order to show that mentalist discourse lacks ontological import, Sellars pursues a 'Methodological Behaviourism' according to which mental episodes are causal antecedents of, yet modelled on, overt spontaneous linguistic episodes. This amounts to an anti-foundationalist attack on the 'myth of the given': to be aware of something is *ab initio* language determined. Since mental episodes, like the linguistic episodes on which they are modelled, can be characterized exclusively in terms of their function, the phenomenon of intentionality can no longer appear to support a dualist philosophy of mind (Sellars 1963, Chapter 5; 1979, Chapter 4; 1981).

Ad 3. Sellars advances a nominalist theory of predication in the true sense of a *flatus voci* approach, claiming that predicate terms have no semantic function whatsoever. He champions a modified Tractarian picture theory of linguistic representation by comparing observation languages with mechanically produced maps. Like the marks on a map, the observation sentences of a language form a system of names standing in certain configurations. This system represents a causal projection of the environment of a particular linguistic community which selects the relevant set of projection rules. Names, not *qua* linguistic items but *qua* material tokens, are causal representatives of 'characterized objects', while predicate expressions provide only a dispensable material context for the articulation of names (Sellars 1963, Chapter 2; 1979, Chapters 4, 5).

Ad 4. In his most recent investigations into ontology, Sellars develops more fully his account of the causal antecedents of true (i.e., adequately projected) empirical sentences and introduces an ontological frame with 'pure', i.e., genuinely subjectless, processes as basic constituents (represented by sentences with impersonal subjects like 'it is thundering'). Sellars argues that categories

pertaining to the philosophical interpretation of science (the 'Scientific Image') and of common sense (the 'Manifest Image') can be integrated into a comprehensive categorial scheme only on the basis of an ontology of pure processes; only a process-ontological scheme, Sellars claims, allows for 'electronings' and 'reddings' to be equally basic constituents and can thereby, in a non-reductive way, accommodate persons along with scientific entities. Since pure processes inseparably combine the 'this'-aspect and the 'such'-aspect of a characterized item, Sellars's process metaphysics seems to rearticulate his nominalist intuitions about the ontology of changing individuals as formulated in his earliest writings. Thus, reviewing his work from his latest writings, the true motive for Sellars's consistent pursuit of a nominalist-naturalist scheme throughout his work appears to be not ontological parsimony but a 'unified vision of man-in-the-world' (Sellars 1963, Chapters 1, 9; 1981).

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JOHANNA SEIBT

Selz, Otto

Otto Selz was born in Munich in 1881. There he completed his law studies with high honours in 1908. He had also read philosophy and psychology (in Munich under Theodor Lipps and in Berlin under Carl Stumpf), and, in 1909, he obtained his Ph.D. in philosophy with his thesis, *The Psychological Theory of Cognition and the Transcendence Problem*. In 1912, Selz became *Privatdozent* at the University of Bonn on the strength of a habilitation thesis on *The Laws of Ordered Thinking*. In 1923, he was appointed to the chair of philosophy, psychology, and pedagogy at the Handelshochschule, Mannheim. As a Jew, Selz was dismissed in 1933 and shortly thereafter was deprived of his opportunities to publish in Germany. In 1938, he was detained in the concentration camp of Dachau. He was released in 1939 and lived in Amsterdam until 1943, when he was deported to Auschwitz. He died there on 27 August 1943.

Selz is regarded as the last member of the Würzburg School of thought psychology in reflection of the fact that he had studied with Oswald Külpe (1862–1915) and Karl Bühler. Like other members of the school, Selz started out from a critique of association psychology and went on to develop an experimental approach to the scientific study of thinking.

Selz's own methods were modifications of the introspective methods of the Würzburg School. Subjects were given certain '*Aufgaben*' (tasks), as for example to find superordinate or co-ordinate concepts, causes for given effects, definitions of a stimulus word, and so on. Subjects then had to describe their experiences during designated stages of the thinking process. The task was varied from experiment to experiment.

The analyses of those experiments were published in Selz's *Laws of Ordered Thinking* and in his *On the Psychology of Productive Thinking and of Error*, published in 1922.

The laws of thinking put forward by Selz utilize the following concepts:

1. Instead of the associative connection of the contents of thoughts known to earlier generations of psychologists, Selz asserted the existence of an empirically observable connection between such contents via a cognitive operation which he called *Komplexergänzung* (complex completion).

2. Instead of focusing on *contents* of thoughts, however, Selz moved over to the investigations of the *operations* of thinking.
3. The dynamic force behind thought processes is, he held, to be understood in terms of a schematic anticipation of the total task that has been set.
4. The task initiates mental operations, and the latter are themselves strongly determined from stage to stage, so that the initial fixed stimulus determines the final specific answer.
5. A person is a '*Vereinigung*' (integration, union) of all specific behavioural sets.
6. The person is a synthetically constructed whole of specific behavioural sets and the pivot of each single piece of behaviour. The operations of a person are as a result directed in a holistic fashion.

Thinking, for Selz, is a continuum of what he calls reproductive and productive operations. On the one hand, there is the reproductive actualization of knowledge, something which for Selz takes the form of a present consciousness of already existing relational facts. (One can detect here the influence of Alexius Meinong.) Productive operations come into play where such reproduction is not sufficient. Here Selz distinguishes such examples as '*Mittelaktualisierung*', or the routine actualization of already known means to the end which is the solution; '*Mittelabstraktion*' or the abstraction of means; and '*Mittelanwendung*' or the productive utilization of previously established abstractions. Thinking is not just a matter of knowing ('*Wissen*'), but rather an operation that uses '*Wissen*' but consists also in the finding of means for such use. Thinking is therefore a way of acting, a matter of performance.

Selz's theories remained relatively unknown, even to his contemporaries. There was some criticism by Bühler, who denied Selz's strongly mechanistic account of the specific reactions in thinking. Selz here acknowledged some of the force of Bühler's objections and went on to proclaim that psychology should become a "biology from the inside". Kurt Koffka (1886–1941), K. Duncker, and Max Wertheimer (1880–1943) did not cite him (a fact that Selz himself criticizes), although his concept of the completion of a complex was in some ways a forerunner of their laws of Gestalt. Humphrey (1951) regards Selz's work as "notable research", but gives his approval only to Selz's contributions on reproductive thinking. The Dutch psychologist Adrian De Groot made use of Selz's hypothesis and found it proved fertile in the analysis of the strategies of skilled chess players.

Herbert Simon (in Frijda and De Groot 1981) has pointed out that Selz's work anticipated many of the information-processing ideas of the 1950s as well as current approaches to cognitive psychology. He points out that the computer simulations concerning artificial intelligence he had carried out with A. Newell in the 1970s can be seen, with hindsight, to have been based on the same structures that Selz had described as the very steps of thinking processes: directed associations related to a task (*Aufgabe*); mechanical sequences of actions produced by general couplings or linkages (*generelle Verknüpfungen*); schematic anticipation of the solution; means-end analysis (*Mittelabstraktion*); and so on.

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Semantic Conventionalism

Semantic conventionalism is a special kind of conventionalism with regard to the meaning of scientific terms and of sentences in theories. It is not so much a linguistic as an

epistemological doctrine, for its primary concern is not the relation of words to what they 'mean', 'designate', 'refer to', and so forth – the conventional character of these relations is presupposed in any case – but the epistemological question: what can and do we know of the entities we pretend to denote by the terms of our theories? In so far as this question is answered rather sceptically, semantical conventionalism is more akin to phenomenalism and ontological scepticism than to realistic theories of semantics like Gottlob Frege's theory of reference or Hilary Putnam's theory of natural kinds.

Semantical conventionalism can be traced back to the Greeks. Democritus (*c.* 460–*c.*370 BC), especially, is said to have been the first to argue that there is no *natural* relation between names and things named. The proper epistemological form of semantical conventionalism is, however, the result of a transformation of Kant's 'transcendental' philosophy towards a structuralistic view of scientific theories during the 19th century.

Though already Kant had declared the 'thing in itself' to be something unknowable, he still defended the view that we are in 'possession of synthetic judgements *a priori*', not only in mathematics and science but in metaphysics too. As is well known, this view of knowledge ran into basic difficulties of two kinds when confronted with the methods and results of advanced mathematics and modern science:

1. Richard Dedekind (1831–1916) and Gottlob Frege maintained, in direct opposition to Kant, that mathematical judgements are *analytic* in the strong sense that arithmetic – including higher analysis – could be based on pure thinking without any recourse to geometrical intuitions. It could be seen, in other words, as an extension of logic in the broad sense of the term, including set-theoretical notions and principles.
2. Kant's theory of space and time as *a priori* forms of intuition was called into question when science began to consider different forms of space and time as at least logical possibilities. As a result, the question as to which geometry would be necessary for the very possibility of experience could no longer be answered by *a priori* reasoning, but had become once and for all a pragmatic problem.

These difficulties led, however, not (as one might have expected) to the immediate rejection of Kant's philosophy and its substitution by logical empiricism, but rather to a gradual transformation of Kantianism in general and to semantic conventionalism in particular. (Semantic conventionalism, incidentally, is by no means the only successor of Kant's philosophy – nor even the most important one – but by any scientific standards it is doubtless the most sophisticated one. Besides the other forms of conventionalism like Jules Henri Poincaré's (1854–1912) geometrical conventionalism, Pierre Duhem's holism, W. V. O. Quine's ontological relativism, and Rudolf Carnap's principle of simplicity, it is mainly Karl Popper's critical rationalism and, of course, the neo-Kantian schools in Germany, which all pretend to be the legitimate successor to Kant's critical philosophy.

The transformation, which is mainly connected with the names of Gustav Kirchhoff (1824–87), Hermann von Helmholtz (1821–94), and Heinrich Hertz (1857–94), is best characterized as a change in Kant's underlying assumption as to the two sources of all our knowledge: intuition and thinking. These are according to Kant both *necessary* for knowledge of objects and at the same time mutually *exclusive* in the sense that one cannot be reduced to the other and vice versa. The semantic conventionalists, by contrast, argued that all our knowledge about the external world is based on a single process, namely the process of *symbolization*, which cannot be separated into two distinctive parts.

The first step in this direction was the turn away from the explanatory to the descriptive view of science. It is entailed in Kirchhoff's demand that "it is the task of mechanics to *describe* the motions going on in nature, and this completely and in the simplest way, but not to find their *causes*" (*Vorrede zur Mechanik*, 1877). In other words, Kirchhoff restricts the task of science to the mathematical

description of the phenomena and of their relational structures.

The second and more important step was made by von Helmholtz. As a physiologist of sense perception, von Helmholtz had the idea that the sequence of our inner sensations – no matter whether conscious or not – can be analysed as a kind of natural language in which the phenomena of the external world would speak to us; this analogy was based on two resp. three epistemological assumptions:

1. Sensations are not pictures but 'symbols' of the objects they represent; that is to say the qualities of our inner sensations like sound, heat, and colour are neither similar nor even identical to the qualities of the things represented – as one would expect from a good picture – but are mere *functions* of the different sense organs stimulated by the external object.
2. Sensations are related to the objects of the external world by the law of causation, which means roughly that under the same circumstances the same sensations will always occur. The law of causation is a *transcendental* law in Kant's sense, that is to say, it is not the result of some experience but instead a necessary presupposition for the very possibility of experience. What is merely empirical is stated in the next point.
3. Although the single sensations are not pictures but symbols, still the *sequences of sensations are pictures* in the literal sense that their order is at least similar to the order of causes, that is to the sequence of the external phenomena by which they are produced. In present terminology one would say that the relation between the sequence of inner sensations and their external causes is that of a *structural isomorphism*.

The final step towards semantic conventionalism was achieved by Hertz. He replaced the 'transcendental' law of causation by certain *rules of representation* stipulating the coordination between the results of singular measurements and the conceptual symbols or pictures constructed by the mind. It is crucial for a correct understanding of semantical conventionalism, however, that the construction of pictures is *not uniquely determined by experience*. Different, though empirically equivalent pictures are possible, so that the question of which of these pictures is the most *appropriate* one will depend not only on the requirement of correspondence with the phenomena but also on such criteria as 'simplicity and distinctness'.

Of two empirically equivalent pictures, that picture is more distinct which pictures more of the essential relations beyond the phenomena; likewise, one picture is simpler than another if it contains a smaller number of empty terms (terms which refer, so to speak, to fictitious entities not part of the reality underlying the phenomena). Such criteria are – by their very nature – not verifiable in principle. Thus, the choice of a picture, assuming a certain ontology behind the phenomena, becomes a matter of convention.

> The pictures we are here speaking of are our ideas of things. With the things themselves they are in agreement in *one* important respect, namely, in satisfying the above-mentioned requirement [of correspondence]. Yet it is not necessary for fulfilling their purpose that they should be in agreement with the things in any other respect whatever. As a matter of fact, we do not know, nor have we any means of knowing, whether our ideas of the things are in correspondence with them in any other than this *one* fundamental relation (Hertz, *The Principles of Mechanics*).

Hertz, dissatisfied with the notion of force, 1956 (1st ed. 1894), preferred a 'simpler' picture of mechanics, in which the problematic notion of force played no role. Like Kirchhoff and Ernst Mach, he supposed the notion of force to be an empty term, denoting no real entity.

Conventionalism with regard to ontology is by no means restricted to Hertz; for different reasons Duhem and Quine held similar views. Historically, Hertz exercised a great influence on Ludwig Wittgenstein's *Tractatus*. Today Bas van Fraassen defends an image of science, called 'constructive empiricism', which is systematically related to that of Hertz.

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ULRICH MAJER

Semantics

Semantics is, roughly speaking, a study of relations between languages and what they refer to. Another popular description is that semantics is an analysis of relations between linguistic expressions and their meanings. However, some influential writers (e.g. W. V. O. Quine) divide semantic studies into the theory of reference and the theory of meaning. Alfred Tarski, the founder of modern logical semantics, understood by it the theory of reference but in his concrete studies looked at semantic relations as holding between expressions equipped with meaning and their references.

Formal semantics considers semantic relations with the help of mathematical methods of modern logic. In order to do this, both members of a general semantic scenario, namely a language, say L, and its subject matter, say M must be described as mathematical objects: L as a formalized language and M as a mathematical structure which is conceived as a semantic model of theories, including logical ones, formulated in L. Formal semantics covers today a comprehensive class of logics and theories based on, for instance, classical first-order logic, higher logics, free logic, intuitionistic logic, modal logics, many-valued logic, infinite logics, and so on (for general surveys see Barwise and Feferman 1985 and Gabbay and Guenthner 1983–9). Various formal semantic theories lead to different ontological problems; it should be noted that ontological problems of formal semantics concern L as well as M.

As a detailed description of formalized languages may be found in many books (for instance in surveys mentioned above), the following sketch is very general. The description of L as a formalized language begins with its vocabulary. The scope of a vocabulary depends on the logic in question. For instance, the vocabulary of L_1 (the language of L_1 – the first-order logic without identity and functional symbols) consists of: an infinite sequence of individual variables, a possibly infinite sequence of individual constants, a list of logical constants (sentential connectives, quantifiers), and a list of auxiliary symbols (dots, brackets). Formulas of L_1 are recursively defined over the vocabulary of L_1; perhaps it is important to note that the property 'being a formula of L_1' is decidable.

Thus, L_1 is a denumerably infinite totality of finitely long formulas. Many logics share this propety of L_1 but there are also different languages. The language of Leśniewskian ontology has a finite vocabulary; it is a finite but extendable totality of finite formulas. On the other hand, infinite logics have infinite vocabularies and infinitely long formulas. Doubtless, the cardinality of vocabularies and sets of sentences as well as possible lengths of formulas may be viewed as ontological properties of languages.

The next problem concerns the nature of signs occurring in vocabularies of languages used in formal semantics. They may be regarded either as tokens or as types. Both views were represented in the history of modern logic. According to Stanisław Leśniewski, linguistic expressions are concrete physical objects; the same view was advocated by Tarski (in the 1920s) and Tadeusz Kotarbiński (1886–1981), both of whom were influenced by Leśniewski in this respect. Of course, there is an evident connection between this view and regarding languages as finite totalities of finite formulas. However, the view that linguistic signs are types rather than tokens is much more prevailing. Since a description of sign-types is difficult, (if possible at all) without an appeal to abstract objects, the difference in the two

ways of looking at linguistic expressions is important from the ontological point of view.

The two ontological problems of formal semantics mentioned are induced by syntax of formalized languages; of course, they are also ontological problems of semantics because semantics assumes syntax. The third ontological question connected with languages used in formal semantics concerns meanings of linguistic expressions conceived as their intensions. Although some practitioners of formal semantics follow Tarski and Quine and try to avoid all intensional problems in favour of extensional ones, the ontology of meanings often comes back, especially through the stormy development of intensional logic in recent years. Intensions are construed in intensional logic as functions from expressions to intensions and such solutions involve an appeal to abstract entities.

The last problem concerns the ontology of M. A model M of a formal system is an ordered tuple which consists of a domain D of possible values of individual variables of a given L and sets of denotations of non-logical (excluding the auxiliary devices) symbols occurring in the vocabulary of L. For instance, if we have to do with L_1, D consists of individuals, fixed elements of D are denotations of constants, subsets of D are denotations of unary predicates, and subsets of D^n (i.e. n-termed Cartesian products of D with itself) are denotations of n-ary relations. L and M are connected by a so-called valuation function which ascribes entities from M to expressions of L. Assuming that a valuation is given, we can define fundamental semantic concepts: satisfaction, truth, denotation, and so on. This is one way to do formal semantics. Another way consists of introducing semantic concepts by suitable axioms; for comparison of various methods of creating formal semantics, see Rogers (1964).

This outline of formal semantics clearly shows that its constructions are set-theoretical. Syntax of formalized languages also uses set-theoretical concepts but devices employed in syntax are rather modest and usually do not exceed effective methods. The situation in semantics is quite different. Even formal semantics for L_1 requires advanced set theory with such strong axioms as the axiom of choice or its equivalents. Thus, one may say that the ontology of formal semantics for L_1 and, *a fortiori*, its various extensions, assumes set-theoretical ontology. If we pass to modal logic and its formal Kripke-style semantics, the situation is much more complicated because Kripke-frames induce new problems connected with modes of being of possible worlds; note also that propositions regarded as meanings of sentences are often introduced as functions from sentences to possible worlds.

However, many logicians who are less or more radical advocates of nominalism look for modest ontologies of formal semantics. The main difficulty in a 'nominalization' of L_1 and its extensions is as follows: even if the object language is nominalized to some extent, strong set-theoretical devices are needed in the metalanguage in which formal semantics is realized. Thus, ontological reductions in formal semantics are as difficult as in classical mathematics. The situation of nominalists is more promising in semantics based on Leśniewskian ontology because, at least in the elementary Leśniewskian calculus of names, denotations of common nouns are not sets or relations; however, higher Leśniewskian ontology creates some difficulties for nominalistic reductions.

Important ontological problems are connected with assumptions about D. The classical version of L_1 is based on the presupposition that D is non-empty. Moreover, the individual constants of L_1 cannot be non-designating singular terms: such terms, if they occur, must be eliminated by devices like Bertrand Russell's theory of definite descriptions. Leśniewskian logic and so-called free logic do not require the assumptions of non-emptiness of D; thus, formal semantics for these logics are more neutral ontologically than L_1 is.

Special problems are connected with the possible ontological import of semantic results achieved in metamathematics, especially with the Löwenheim-Skolem theorem, Gödel theorems, and the Tarski theorem on undefinability of truth. It seems that those theorems, labelled – not by accident – as limitative results, show that ontologies of theories usually exceed the expressive

power of their languages. If so, this fact is of fundamental importance for formal ontology.

Certainly, formal semantics does not solve traditional ontological controversies. But it contributes to a better understanding of the problems which ontological theories confront.

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JAN WOLEŃSKI

Sensus Communis

Sensus communis (κοινὴ αἴσθησις or 'common sense') is an Aristotelian notion (apparently unconnected with the more modern notion found e.g. in John Locke and Thomas Reid) which is used to account for our capacities of perceiving objects of perception through more than one sense, of distinguishing and relating the proper objects of the different senses, and perhaps of being reflexively aware of our perception. The notion is introduced by Aristotle in *De Anima* 418a17–20: potencies such as the senses are distinguished by their objects, so since there are objects which are common to more than one sense, there must be a 'common' sense.

Each of the five external senses has its proper object: but there are also objects of perception that we can perceive by more than one sense: movement, rest, number, shape, and size; the 'common' objects of sense. They are perceived 'in their own right' rather than 'coincidentally'. We do indeed perceive the shape of a heap of sugar, through our senses of touch and sight: it is not like the case of 'perceiving the sweet coincidentally by sight', as might occur when we see the whiteness of the heap of sugar while we know that what is white in that way is also sweet (418a20–4). These 'common' objects of perception, then, are perceived in their own right, and so must be perceived by some sense-power; but they are not perceived as the proper objects of any of the five senses. So Aristotle postulates a common or general sense-power by which we perceive them.

But shape, say, is truly perceived by touch and sight: the common objects of perception are not, as it were, proper objects of the common sense. Common sense is a distinct perceptual capacity, though it is exercised through the proper senses. If we can understand *De Anima* 425a14–b3 as meaning that common objects of perception are perceived by the common sense in their own right but coincidentally by the proper senses, it may be possible to equate the common sense with our capacity for exercising the proper senses jointly, or following medieval Aristotelians in calling it the root and origin of all sensing.

The notion is developed in *De Anima* 426b8–29: it is by the common sense that we are able to distinguish the perceptions of one sense from those of another. Sight distinguishes dark from light, and taste sweet from bitter: but it is only by the common sense – the capacity of exercising the proper senses together – that we distinguish dark from bitter. It is also by the common sense that we are able to judge that something perceived by more than one sense is one thing. The discussion about reflexive awareness of perception in *De Anima* (ibid.) is ambiguous and inconclusive, but seems to suggest that it is in virtue of, say, sight that we know that we are seeing. Quite different is the doctrine put forward in *De somno* 455a13–21, which besides summing up the functions of the common sense already mentioned argues that sight is aware only of colour: it is by the common sense that we are aware that the sight is affected by colour. This last point continues to be disputed among Aristotelians.

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C. F. J. MARTIN

Set Theory

The theory of sets constitutes, on the one hand, the theory of arbitrary collections, and, on the other, the most widely accepted mathematical theory of infinity. Its philosophical interest stems from both its mathematical and its logical importance. As a separate mathematical discipline, it arose primarily from the work of Georg Cantor (1845–1918) in the last quarter of the 19th century. Its connection with logic arose through the developments in the foundations of mathematics wrought first by Gottlob Frege and then by Bertrand Russell. In the early 20th century, set theory was successfully axiomatized in such a way as to avoid the newly discovered set-theoretic antinomies. The effect of this has been to emphasize more the mathematical aspect of the theory. This axiomatization began with the work of Ernst Zermelo (1871–1953), and was followed by the contributions of Abraham Fraenkel (1891–1965), Thoralf Skolem (1887–1963), and John von Neumann (1903–57). Together with the development of precise logical frameworks, this led to formal systems such as the Zermelo-Fraenkel system (*ZF*).

Sets quickly became basic in late 19th-century analysis, and fundamental to mathematics. The reason for this is that set theory allowed the collection of numbers or points into a set without there being any obvious form, geometric or otherwise, to hold the elements together, and then, despite this, insisted that such a collection be treated as a self-subsistent mathematical object, i.e., as an object as legitimate and as justified as numbers or well-known, even intuitable, functions or forms. In particular, it was allowed that the sets so produced might be infinite as well as finite, and that the mathematical properties they can possess will include those of being ordinally and cardinally numerable. The ensuing abstractness of sets should be seen in tandem with the so-called arithmetization of analysis, i.e., with the movement towards defining the fundamental objects arithmetically, and hence making them more abstract as opposed to invoking entities which rely on geometrical intuition. Seen in this context, sets had both a liberating and a creative effect on mathematics, pointing this discipline in an unashamedly abstract direction, and either enabling old concepts to be extended in ways that suggested the solution of existing problems, or stimulating the isolation of new concepts which could be used in equally fruitful ways. (A useful illustration of this mixture of creation and extension is provided by the concept of the measure of a set, essentially a generalization of the notion of area, and its effect on the theory of integration.)

The impact of set theory on mathematics suggests that sets are indispensable. However, their use in the precise definition of basic concepts, such as that of real or natural number, suggests that sets might be sufficient as well, i.e., that mathematics is reducible to set theory in some sense. It does turn out that all the basic concepts of mathematics can be expressed set-theoretically, and thus that the basic disciplines can be translated into the theory of sets. However, by itself this should not be taken as showing that mathematics is nothing but the theory of sets, or that set theory is a foundation for mathematics. At best it shows that set theory can act as a universal language, and that it is possible to squeeze everything into this framework in much the same way that it is possible to express every theory as a formal system if the need arises. Moreover, the fact that there is one universal language does not mean that there cannot be others, and the expressibility of all of mathematics in this language might be contingent rather than necessary. A rival language has appeared in recent years in the shape of the theory of categories, but decisive arguments in favour of one universal language over another seem to be lacking. Each framework seems the correct one for certain purposes.

However, the universality of set theory does reflect its connection with logic, a connection which goes back to the work of Frege and Russell. If sets are to be arbitrary, and can be infinite, there must be some means of specifying them. It is clear that all the objects satisfying a property form a collection. But does this collection form a set? The answer originally given to this by

Frege (implicity) and then separately by Russell (explicitly) was 'yes', an answer encapsulated in the so-called principle of comprehension (*CP*). As long as *CP* was accepted in some form, there seemed good *prima facie* reason also to accept the thesis that mathematics can be construed as nothing but general logic. For one way to view logic is that it is concerned with the way that arbitrary concepts or properties behave, and *CP* seems to state a quite general law of this kind, for it says that the full extension of any concept or property can be considered as a set. If this principle is taken to be the basic one about the theory of sets, it is not hard to reduce mathematics to a theory based on this.

However, the set-theoretic antinomies show that the *CP*, when taken as a principle about sets, cannot be right: the extensions of some properties cannot be sets on pain of contradiction. This is shown clearly by Russell's paradox, discovered independently by Russell (in 1900) and by Zermelo (in 1899 or 1900). Intuitively, some sets belong to themselves and some do not. The collection of all chairs in the room is not a chair in the room, and thus does not belong to itself. But the collection of all sets, if it exists as a set, must belong to itself. Thus, 'not belonging to itself' seems to be a perfectly good property of sets, and one would expect of any set that it either possesses the property or not. According to *CP*, the extension of this property is itself a set, say the set *R*. But if we now ask whether *R* belongs to itself, whichever of the two answers we start with, we can derive from it the opposite. Hence, *R* belongs to itself if and only if it does not belong to itself – a contradiction. Other more complicated antinomies were discovered before this (those of the greatest ordinal and of the greatest cardinal are the best known), but all involved other assumptions which could be, and were, challenged. Russell's paradox, however, has the merit of focusing attention on *CP*, and, as Russell recognized, this cannot be the central principle on which to base the theory of sets.

The failure of the principle illustrates one thing on which set theory clearly rests – its attempt to blur type distinctions. *CP* says that the extension of any property can be treated as an object exactly like the objects which fall under the property, so much so that we can ask of this extension whether or not it satisfies the same properties as do (some of) its members, including the property in question. What the refutation of the principle shows is that the blurring goes too far in that it cannot work for *all* extensions. Having recognized *CP* as a logical principle, Russell wanted an obvious and natural logical substitute. He conjectured that type distinctions are always logically important, and in consequence introduced a theory of types which, when looked at in one way, is designed to institute for extensions the wholesale type distinctions which Frege had insisted on for concepts (or Fregean functions). This may indeed provide a persuasive logical framework; but it became clear that this, by itself, is not strong enough to reproduce classical mathematics – other principles, not obviously logical in character, have to be added. On the other hand, the axiomatizations of set theory spawned by Zermelo do not pretend to be presenting pure logic, and they might be seen as still attempting to blur as many type distinctions as possible consistent with avoidance of the antinomies and with the development of mathematics in set-theoretic terms. On the one hand, sets are treated as extensional collections, in that two sets are said to be the same providing only that they have exactly the same members. Thus, in a certain sense, the members constitute the set. But, on the other hand, sets are taken to be objects no different in type from the elements that go to make them up. This is important in the uniform, reductionist use of the theory mentioned above. Thus, if all the mathematical objects (numbers, functions, groups, fields, spaces, etc.) are sets of some sort, then they are all of the same type and can be mixed and compared indiscriminately. One way to look at mathematical set theory is to say that it starts with some version of Russell's theory of types, and then permits as much type collapse as is consistently possible.

Despite the failure of *CP*, the strength of mathematical set theory still rests on its having available at least one principle for converting arbitrary properties into sets. In this respect, the Zermelo axiomatizations replace *CP* with the so-called axiom of sep-

aration, which asserts (in one version) that the extension of an arbitrary property is a set providing that it is already enclosed within a set. Thus, 'separating' out extensions from a set (as opposed to the 'whole universe') is taken as a legitimate part of set formation, mimicking the way that the existence of sets is frequently established in mathematics. Of course, this has to be accompanied by other specific principles of set formation in order to yield sufficiently many, or sufficiently extensive, sets from which to separate out others. The most important of these are embodied in the axiom of power set (which says that the collection of all subsets of a given set is a set), the axiom of union (which says that the members of members of a set form a set), and the axiom of infinity (which says that there is at least one infinite set). The first two of these axioms are of an iterative form, that is, they state: 'Given any set a, there is a set b . . .', which means that once a new set has been demonstrated to exist, we can apply the axiom to that set as well. Thus, using the axiom of infinity, we can prove that there is a set of natural numbers; using the power set axiom, that there is the set of all subsets of this; using the power set axiom again, that there is the set of all subsets of this, etc. These axioms are sufficient for most ordinary mathematical purposes, certainly for the construction of the real number continuum and operation with it.

The ZF system is built, not on the axiom of separation, but rather around the axiom of replacement due to Fraenkel and Skolem, an axiom which says that, given any set a, and any means of 'replacing' the members of a with other elements, then the replacement collection formed in this way from a will also form a set. Separation is based on the idea that a collection which is not more 'comprehensive' than a set must also be a set; replacement, however, says that a collection which is no 'bigger' than a set must also be a set. None of the efficacy of the separation principle is lost in the ZF system, for it is easily shown that replacement entails separation. But the ZF system is, on the contrary, much stronger.

In many ways, the ZF system has come to be accepted as the basic standard system of set theory. The main reason for this is that the whole theory of infinite ordinals and cardinals, roughly as Cantor envisaged it, can only be incorporated by using the full strength of the axiom of replacement, something first shown by von Neumann. This furnishes at least one reason why ZF can claim to be the core of Cantorian set theory. But the reconstruction of Cantorianism is due, not just to the axiom of replacement, but to the presence of Zermelo's axiom of choice (AC) as well. Both axioms together allow it to be shown that every set can be 'counted' by an ordinal. This constitutes the basis of Cantor's theory of infinite cardinality, and is a strong version of the well-ordering theorem (WOT), which says that every set can be put into well-ordered form. (WOT was first proved by Zermelo, using AC, in 1904. In Zermelo set theory, with separation and without replacement, WOT can be proved, but one cannot prove the existence of enough ordinals to count every set.) AC is one of the most controversial principles ever to be used in mathematics. The reason lies in its purely existential nature. It can be stated in many ways, but one standard form asserts the existence, for any set, of a function (a 'choice function') which 'chooses' an element from any non-empty subset of the given set. However, the nature of this function is not specified. Thus, we often have no way of defining a choice function for a set, and thus no way of constructing a well-ordering on it, though we are assured that such an ordering exists. AC turns out to have hundreds of important consequences, not only in set theory, but in analysis and algebra as well. Its eventual widespread acceptance thus reflects the willingness of mathematicians to accept existential theorems wihout there being necessarily any constructive means of supporting these theorems. Among other things, this entails that existence has to be treated by means other than the exhibiting of objects which have the properties in question. In the late 1890s, David Hilbert proposed that questions of existence be replaced by that of the formal consistency of the axioms. Showing that $ZF + AC$ is absolutely consistent seems intractable; but is AC at least consistent with the other axioms? The question was

answered positively by Kurt Gödel's work of 1939. *AC* is also independent of the standard *ZF* axioms, as was finally shown by Paul Cohen in 1963. (For a discussion of *AC*, and of some of its equivalents, weaker versions and alternatives, see Fraenkel, Bar-Hillel, and Levy 1973.)

But if *ZF* can claim to embody the essentials of Cantorian set theory, it fails demonstrably to solve the problem which led Cantor to develop the whole theory of infinite number, the problem of the power of the continuum. Cantor had developed a series of cardinal numbers, known as the aleph series, which represent the cardinalities of all well-ordered sets. By *AC* and replacement, it follows that the continuum must have an aleph for its cardinal number. The difficulty of answering the question as to which aleph this is led to speculation that the question cannot be settled on the basis of the standard axioms. In his work of 1939, using the very important inner model of 'constructible sets', Gödel (1906–78) showed that Cantor's conjecture that the continuum has the second aleph as its cardinal number (Cantor's continuum hypothesis – *CH*), is at least consistent with the usual axioms of *ZF*. However, in 1963 Cohen showed that its negation is also consistent with these axioms, in other words, that *CH* cannot be proved from *ZF*. Indeed, it follows from the technique of forcing invented by Cohen that, not only is it consistent to assume that the continuum does not have the second aleph as its power, but that models can be constructed in which the cardinal number of the continuum can be virtually any aleph whatsoever. In other words, it seems that the continuum problem is as far from being settled by the standard axioms as it could possibly be.

Gödel suggested (1946 and 1964) that we might look for other, natural axioms to add to *ZF* which can help to decide the problem of the power of the continuum, in particular, strong axioms of infinity. The reasoning behind this stems from that work of Gödel's which led to the incompleteness theorems. According to this, consistency statements for *ZF* can be framed as number-theoretic statements, statements which cannot be proved from *ZF* if *ZF* is indeed consistent. But according to the Completeness Theorem (which says that a first-order theory is consistent if and only if it has a model), the provability of these consistency statements ought to be equivalent to the existence of models for the axioms. Using the von Neumann cumulative hierarchy, the existence of models for *ZF* and its extensions can be shown to depend on the existence of ordinals larger than those which can be proved to exist from the standard axioms. Thus, as more and more ordinals are 'added', more and more number-theoretic statements become provable. Gödel conjectured that all statements undecidable in the original system might be decided in this way, including *CH*. Many such large number principles have been studied, and have indeed turned out to provide information about sets, like the continuum, which are relatively low down in the set-theoretic hierarchy, despite the fact that they seem to concern only sets (ordinals) which are high up. The axiom of measurable cardinals is perhaps the best known of these principles. One part of Gödel's conjecture is therefore vindicated. However, very little information about the size of the continuum has been gleaned from this, and the problem seems as intractable as ever.

There is surely some connection with the existential nature of *AC* here, for it is this which assures us that the continuum is equivalent to some aleph, while the independence results, and the 'failure' of the strong axioms of infinity programme, tell us that we cannot know which. This parallels what we know about the well-orderability of the continuum. *AC* tells us that there is a well-ordering; and yet we know from work of Solomon Feferman that it is consistent to assume that there is no definable well-ordering of the continuum, thus, no well-ordering which we can actually write down. (See Fraenkel, Bar-Hillel, and Levy 1973, p. 69.)

The failure of the *ZF* system in this respect might be seen as the failure to pin down the notion of infinity sufficiently well. It is sometimes suggested that this is shown by another famous result, technically connected to the independence of *CH*, the result known as the 'Skolem paradox'. The Downward Löwenheim-Skolem Theorem (*DLST*) tells us that,

if a first-order theory in a countable language has any model at all, then it must have a countable sub-model, a model which will satisfy exactly the same sentences as the original model. This result can be applied to the first-order version of *ZF*. Let us assume that *ZF* has a 'standard', intended model, then the *DLST* tells us that there must be a countable sub-model of this. However, this sub-model must contain an element which acts as the continuum, and it is not hard to arrange it so that this 'continuum', and every other infinite set of the sub-model, is countable. However, *ZF* can prove Cantor's Theorem, from which it follows that the continuum must be uncountable. The sub-model must satisfy the sentence which expresses this, although it must satisfy it with an object (the 'continuum') which is countable. The continuum of the model is therefore both countable and 'uncountable'. But although Skolem's result is paradoxical, it is not genuinely contradictory, for the continuum of the model is not at the same time both countable and uncountable in the same sense of 'countable'. It is quite legitimate to assume that the model contains no mapping which takes the natural numbers (of the model) one-to-one onto the continuum (of the model). This is enough to show that the continuum satisfies Cantor's Theorem, and is thus uncountable, even though there must be such a mapping outside the model, because we know that the continuum of the model is actually countable. This yields the connection between the Skolem paradox and the independence results. In the sub-models in question, both the continuum and, say, the second aleph are countable, and, although the model might not contain a one-to-one mapping from the continuum onto the second aleph, the observation that they are both countable raises the possibility that there might be models in which this 'external' state of affairs is actually realized internally, thus showing that the continuum (of such a model) is equivalent (in the model) to the second aleph, thus refuting *CH*. Cohen's work confirms this, and the forcing technique shows how to construct such models.

However, despite not being contradictory, the Skolem paradox does make it seem as if first-order *ZF* set theory is unable to tell the difference between this countable 'continuum' and the 'real' continuum (presumably uncountable) of the intended model. It has been concluded from this that either the concept of uncountability is incoherent or that *ZF* is not capable of capturing it. It seems implausible that something so basic to modern mathematics as uncountability would be incoherent, and one alternative is to suggest that the first-order formulation of *ZF* is to blame. The *DSLT* does not work for second-order logic, and in any case the formulation of separation, or replacement, in the first-order theory seems somewhat constrained. Since there is no quantification over properties, these axioms have to be formulated as schemata, there being one axiom for each property expressible in the language. However, there are only countably many such expressions, and hence only countably many instances of the axiom. Some hold that these instances do not seem to add up to the intuition that the axioms are to cover *arbitrary* properties.

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MICHAEL HALLETT

Simplicius

Simplicius, one of the last generation of predominantly pagan Neoplatonists, was born in Cilicia in the second half of the 5th century, and died after 538. He studied at Alexandria under Ammonius (fl. *c.* 500), and later moved to Athens to work with Damascius, whom he describes as his teacher. At some time after Justinian's edict in 529 forbidding the public teaching of philosophy by pagans, Simplicius with Damascius (*c.* 500–540) and others went to Persia but returned in 532, perhaps to Athens: some now think that he took up residence at Ḥarrān.

Like many of his contemporaries, Simplicius expressed his philosophy mainly in the form of commentary, in his case primarily on Aristotle. Extant are commentaries on the *Categories, Physics, De Caelo*, and *De Anima* (this may be by his colleague Priscian (fl. 500), but the doctrines are those of Simplicius) and on Epictetus's (*c.* 50–120) *Encheiridion*. He probably also wrote one on the *Metaphysics*. These are professional works for scholars rather than the more elementary treatment found in many other commentaries of the period. Though widely regarded as serious and sober expositions of Aristotle they are based on the premiss that Aristotle – and Epictetus too – as well as the pre-Socratics, whom Simplicius quotes frequently and at some length, subscribed to his own version of Neoplatonic Platonism. He himself believed in the characteristically late Neoplatonic intelligible universe of three primary levels of being, Soul, Intellect, and the transcendent One – strictly above Being – with a large number of subdivisions and intermediate entities. Where the One is missing, as often in the *Encheiridion* commentary, that is only because it is not relevant to the matter under discussion.

Simplicius held that it was the commentator's duty to show the essential agreement between Plato and Aristotle, which may be obscured by differences of expression (so e.g. *Cat.* 7.29–32). Thus Aristotelian concepts which had no place in Plato's philosophy had to be explained in Platonic terms. Some results of this procedure were that the quintessence was derived from the traditional four elements as found in Plato's *Timaeus*, and that Aristotle's soul was seen as separate from the body rather than immanent in it as form in the body's matter. A place for the latter concept was found at the lowest of the levels of soul into which Simplicius divided both Aristotle's and his own. Aristotle's categories, which had been seen as Platonic since Porphyry, were interpreted as both logical and ontological. At the same time the meaning of Platonic texts would be shown to fit Neoplatonic ideas by way of discussion of Aristotle. Thus in the course of polemic with Philoponus on the eternity of the world, conducted in the course of exposition of the *Physics* and *De Caelo*, arguments were produced against the literal interpretation of the creation account in Plato's *Timaeus* and used as further evidence that Plato and Aristotle professed the same philosophy.

While Simplicius wrote commentary in a straightforwardly philosophical if not unprejudiced way, his underlying purpose was the typically Neoplatonic one of converting the soul from preoccupation with the world to contemplation of higher reality. Learned and painstaking as they are, his commentaries must be seen not only as an exposition of his own philosophy but also as spiritual exercises.

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H. J. BLUMENTHAL

Singular Terms

A *singular term* is any expression whose function, when used in a particular context, is to *refer to* (*denote, designate*), i.e. to stand for, a single individual. Singular terms that do not manage to refer to anything pose special ontological problems, but even referring singular terms pose metaphysical problems. Many of these problems arise from the attempt to discern the contribution made by a singular term to the information contents in those (declarative) sentences, both true and false, in which the term occurs. The piece of

information contained in a sentence is called a *proposition*. What is the metaphysical nature of a proposition? The natural view is that the proposition contained in 'Russell is clever' is a composite entity whose elements are the individual designated by the singular term 'Russell' and the attribute of cleverness designated by the predicate 'is clever'. Thus, the *naïve theory* holds that the content of a singular term is simply its referent.

The naïve theory gives rise to a number of philosophical puzzles. Gottlob Frege's puzzle arises from a contrast between '$a = a$' and '$a = b$'. When the latter is true, on the naïve theory, both sentences have the same information content; the latter should be no more informative than the former. This flies in the face of common sense. A more general puzzle arises from the apparent failure of substitutivity of co-referential terms in certain contexts. The information content of '$9 > 7$' is a mathematically necessary truth, one that Hegel believed, whereas the content of 'The number of planets > 7' is neither. In so far as '9' and 'the number of planets' are co-referential, the naïve theory cannot accommodate any difference in content between the two sentences. A third puzzle concerns true negative existentials. Since 'The present king of France does not exist' is true, it is not mere nonsense; it has content. Yet on the naïve theory, the sentence cannot contain a complete piece of information, and so cannot express something true. Even opposing theories that ascribe content to the sentence face a problem: in asserting that the present king of France does not exist, one seems to refer to something, France's current monarch, in order to say of him that he does not exist. But then the present king of France exists after all – he is something to which non-existence is attributed – and one's assertion degenerates into falsehood. A more general puzzle arises from any sentence involving a non-referring ('empty') singular term. Bertrand Russell's example 'The present king of France is bald' contains information that is not true. Even theories that accommodate the fact that the sentence contains information face a pressing question: Is the sentence false? If so, one should be able to assert that the present king of France is *not* bald, something that is equally untrue.

Russell's Theory of Descriptions holds that a *definite description* (a singular noun phrase formed from the definite article 'the' or from a possessive nominal adjective), like 'the present king of France', is shorthand for its corresponding uniqueness-restricted existential-quantificational phrase 'some unique present king of France' – which, in turn, is analysed into an *incomplete symbol*: 'Something is such that: it, and nothing else, is a present king of France and it . . .'. By removing definite descriptions from the category of *singular term* ('genuine name'), this theory, combined with Russell's thesis that proper names and demonstratives, as ordinarily used, are disguised definite descriptions, yields solutions to each of the puzzles while retaining the naïve theory's central claim that the content of a *genuine* singular term is its referent. For example, 'The present king of France is not bald' is seen as ambiguous. It may be analysed as 'Something, and nothing else, is a present king of France and it is not bald' (the *primary-occurrence* reading), which is every bit as false as the Russellian paraphrase of 'The present king of France is bald'. Alternatively, it may be analysed as the genuine negation of the latter, i.e. 'Nothing is such that: it is a unique present king of France and it is bald' (*secondary-occurrence*), which is true.

By contrast, Frege saw his puzzle about the informativeness of '$a = b$' as essentially refuting the naïve theory. Maintaining that definite descriptions, proper names, and demonstratives, are all singular terms ('names'), Frege distinguished between the referent (*Bedeutung*) of a singular term and the *sense* (*Sinn*), which is a purely conceptual representation whose function it is to secure a referent for the term – to wit, whatever uniquely fits the representation. The sense, not the referent, serves as the term's content. Terms sharing the same sense automatically share the same referent, but co-referential terms may differ in sense. As an example of the latter, Frege offered 'the point of intersection of lines a and b' and 'the point of intersection of lines b and c', where a, b, and c are the medians of a particular triangle.

Frege extended his distinction between sense and referent to all meaningful expressions, including sentences. The sense of a sentence is its cognitive information ('thought') content, whereas the referent of a sentence is identified with its truth value, either "the True" or "the False". Since 'the present king of France' has no referent, likewise the sentence 'The present king of France is bald' does not refer. Both it and its negation lack truth value; they are neither true nor false.

Frege's distinction between sense and referent immediately solves the puzzles about '$a = b$' and about 'The present king of France is bald'. Frege solved the puzzle about substitutivity-failure by claiming that any meaningful expression occurring in a propositional-attitude context does not have its customary referent, and refers instead in such a position to its customary sense. Substitutivity is restricted to expressions having the same referent *in the position in which the substitution takes place*. This precludes substitution of 'the number of planets' for '9' in the context 'Hegel believed that $9 > 7$'. A similar solution is available for modal contexts ('It is mathematically necessary that $9 > 7$'). Frege's theory can also be made to yield a solution to the puzzle of true negative existentials, by regarding 'The present king of France does not exist' as asserting of the sense of 'the present king of France' that it determines no referent.

Whereas Frege's theory abandons the naïve theory of content, it shares with Russell's theory a treatment of any proper name or demonstrative, ordinarily used, as an expression whose primary contribution to the truth value of a containing sentence is secured by means of something like a property or concept which is semantically associated with the expression, and which forms part of the content of the expression. This paradigm is indeed appropriate for definite descriptions, and versions of the puzzles involving definite descriptions prove that the naïve theory is inadequate. However, during the 1970s the view that proper names and demonstratives function descriptionally was forcefully challenged, notably by Keith Donnellan, David Kaplan, and Saul Kripke. These philosophers argued for their *theory of direct reference*, in part, by pointing out that the descriptional view of names and demonstratives issues incorrect verdicts concerning the truth-values of specific sentences with respect to circumstances in which the actual referent does not fit the associated concept. More importantly, the descriptional theory also issues incorrect truth-values in contexts in which speakers attach misdescriptions to their uses of such terms.

Given the current state of understanding of these issues, it is premature to dismiss the naïve theory, modified to exclude definite descriptions, solely on the basis of the puzzles.

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NATHAN SALMON

Sistology

Sistology is the general study of items in general – whether these items are existent or not, possible or not, objects or not, universal or particular, dynamic (like processes and actions) or static, and so on. Sistology is about what ontology sometimes purports to be about: everything; not everything that exists, or that has being, the restricted brief of ontology, but *everything*: everything that does not exist as well as everything that does. Ontology is, of course, a branch of sistology, but a rather small branch given that most items – including most items of philosophical interest – do *not* exist.

For various bad reasons, including straight prejudice, what does not exist has proved in

many respects much more troublesome, in philosophy especially, than what does exist. While existence has its problems – What is it? How does it occur? – approved empirical procedures do enable a fair grasp to be obtained on much of what does exist. But while these prized procedures have not failed in that existential domain, they have proved insufficient on their own. And their expansion, science, has to proceed far beyond what plainly exists, to many abstractions and idealizations both of its own and of mathematics, in order to organize its theories. Other intellectual arenas, such as literature, proceed even more directly to discourse with what does not exist, to characters, for instance. Inevitably, then, much too in metaphysics (broadly construed to include object-theory) is directed at what does not exist: ideal objects, universals, abstractions, imaginary items, fictions, and so forth. Other parts of philosophy are similarly directed (or redirected): aesthetics, logic, even epistemology and cognitive philosophy (though this is not yet so obvious to practitioners).

Sistology, unlike ontology, treats all items as *having standing* (whence the origin of the term, from Latin *sistere*). Non-existent objects are treated as having standing, of logical and other types, in their own right; they are not refused admission, or removed from view, for instance through large reduction programmes, as happens in standard ontology. The familiar discrimination, characteristic of mainstream philosophical positions, directed against non-existent objects, and most intensely towards impossible items, can be, and is, removed. Like many other forms of discrimination, it is without basis. Yet much of the history of metaphysics can be read as a long history of such discrimination against non-existent items.

There is only one, elementary, strategic move required to get sistology started as a much broader investigation than ontology, the 'trick' of granting the obvious: that non-existent things have a range of properties, that much is true of what does not exist. Instead then of the massive programme confronting any metaphysical theory wedged within ontology, of reducing all those apparent subjects of dialogue about what does not exist, there is a much more straightforward task: namely, that of ascertaining which properties non-existent items do have, what they are *like*, in all their rich and distinctive diversity.

Other tasks of sistology include these: the determination of the general principles that comprehensive classes of items conform to, the provision of a working taxonomy of items, their properties and relations, and the investigation of the principles that significant subclasses of items satisfy – including ideals, attributes, past existents, future existents, etc. Naturally, then, standard concerns of ontology – such as the grounds and constitution, criteria for and analysis of existence (along with parallel investigation and analyses of consistency, coherence, and other intertwined status notion) – will transfer to sistology. But by virtue of their relocation the issues will look different, in a new wider setting; and so too new approaches can be taken, and old obstacles gone around. Evidently many fashionable ontological notions, such as those of ontological priority and divisions, and of ontologies of theories, have wider dual applicability, within sistology. For they have both their fashionable roles, for instance as ontological divisions, and sistological analogues, as sistological divisions.

To avoid the unjustified collapse of sistology into ontology, both standard logical theory, and therewith the mainstream philosophical practice which it underwrites, have to be modified. For the standard theory incorporates the ontological assumption that only existent items have genuine properties, thereby excluding due characterization of non-existent items. Fortunately the first stage of modification of standard logic, enough to get sistological programmes substantially under way, can be comparatively slight, and as far as quantification theory (i.e. pure first-order logic) is concerned need only involve reinterpretation; that is, initial changes can be purely semantical. The adjustment called for is essentially a matter of neutral reinterpretation of subject–predicate expressions and of introduction of neutral quantifiers. Subject–predicate (*sp*) forms such as 'Sherlock Holmes smoked a pipe' and 'the kinase cascade explains characteristics of malignant

cells' do not presuppose (for their truth) that Sherlock Holmes and the kinase cascade exist. Moreover, such judgements entail that, for some *s*, *sp*; for example, that Sherlock Holmes does not exist entails that some item does not exist. Neutral quantifiers, like 'for some', replace the standard existentially loaded quantifiers, such as 'there exists', which can now be defined as 'for some existing', using the predicate *E* for existence.

But an authentic sistology cannot be accommodated within the confines of such simple, if far-reaching, modifications of mainstream logic and thought; at best some sort of inauthentic simulation can. For consider, for instance, contradictory objects, such as a bent stick (of stock illusion) which is bent and also not bent because straight, or the (liar) statement which asserts only that that it is not true. By virtue of what they are, they have contradictory properties, thereby trivializing any theory built upon mainstream logic, where contradictions imply everything. An authentic sistology requires logical reformulation of a more demanding paraconsistent type, which, if extra awkward junk is not just to be carried along, will fall within relevant logic.

As in the law, from which the sistological notion of standing is drawn, so in philosophy, standing alone, which improved logics can effect, is not enough. Standing merely gets items through the logical door; it does not ensure a positive verdict, a satisfactory treatment for items admitted. The further, more difficult, task lies in *giving items their due*, awarding them their full range of features, but no more than their due (without, in particular, assigning them properties they may present themselves as having, such as existence or consistency, but do not possess). Which properties an item has is given or told, within significant limits, by its *source* (which may or may not exist). These sources are diverse, including such items as stories, stories within stories, myths, theories, worlds, scenarios, visions, dreams, and so on and on. For the most part items are like what their sources indicate they are like. But naturally not all sources are always reliable or otherwise satisfactory; for example, perceptual sources are notoriously unreliable as to how things 'really' are under certain unusual circumstances; and some sources deliberately fabricate, as when religious sources try to guarantee that their gods exist by deviously incorporating ontological status predicates at the source (therewith the genesis of ontological arguments). Whence emerge certain limits on what sources (of some appropriate sort) can tell; they cannot directly guarantee status, such as existence or consistency. Thus a division of predicates is presumed, into those more ordinary ones which tell what an item is like, and other predicates which a source cannot simply write in, but which have to be subsequently assessed in terms of what an item is already like. Much of item-theory is presently devoted to explaining what some, and some sorts, of a vast range of nonexistent items are like. This development in sistology is the development of item-theory itself.

Hitherto item-theories have tended to follow the lead provided by Alexius Meinong's object-theory and to focus upon otherwise sourceless objects, items whose sole 'sources' are their descriptions, such as the round square, the blue thing, and so on. In such residual cases, where there is no other source to proceed to, properties of the item are directly reached internally, from the structural description. The round square, for example, by virtue of its description, is round and square. By contrast, the existent round square is round and square and presented as existent, but does not exist. For items alone cannot determine their own status. But the approach through such bare, otherwise sourceless items has distorted and limited the grand theory, seriously underemphasizing its richness and importance. It is much more revealing to begin with items with rich sources such as those of high fiction, interesting mathematics and challenging theoretical science, and to treat the originally emphasized bare objects as default cases: structural descriptions are sources in evacuated contexts when other normal sources fail.

Sistology not merely offers a fresh perspective on many traditional philosophical problems, but indeed cleanly disposes of many of them. More, sistology affords a new and exciting approach to many problems in

theoretical reaches; for instance, a very different philosophy of mathematics, much reoriented linguistic theory, and so on. But naturally proof of such grand claims lies in the doing. It is easy to appreciate, however, how even metaphysics comes to be pursued differently. Items like substance, self, sense-datum, and Tao are not excluded at the outset as having no satisfactory existential or other standing. Rather they are admitted, and investigation proceeds to disclose what they are like, in their various kinds. Only subsequently when this has been revealed, as when the properties of refined kinds are sufficiently clear, can questions of modal and ontological status be properly assessed.

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RICHARD SYLVAN

Situation Semantics

Situation semantics was first proposed by Jon Barwise in his paper "Scenes and other situations" in the late 1970s, and greatly elaborated in his book with John Perry, *Situations and Attitudes*, in 1983, though considerable subsequent developments have rendered this book now of little more than historical interest.

In its present form, situation semantics is best regarded as a general framework for a theory of information and language (both human and machine). Recognition is made of the partiality of information due to the finite, situated nature of the agent with limited cognitive resources. The resource-bounded agent, human or machine, must employ the information extracted from the environment (i.e. the *situation* or *circumstance* it is in) in order to reason and communicate effectively.

One of the basic ideas of situation semantics is the relational theory of meaning, where the meaning of an expression ϕ, denoted by $\|\phi\|$, is viewed as a relation between two circumstances, the one in which the expression is uttered and the one it describes. The relational theory thus provides a conceptual scheme to express the way the agent may utilize information in the circumstances of utterance.

For example, consider a use of the sentence (ϕ): 'I am a philosopher.' The meaning of this sentence is taken to be a relation that holds between two circumstances, an utterance, u, and a proposition, p. The situation u and the proposition p are related by $\|\phi\|$ if and only if there is an individual a and a time t such that

1. a is the speaker in u;
2. t is the time of u; and
3. p is the proposition that a is a philosopher at time t.

This example shows, in particular, how the first person singular pronoun works: the meaning of the word 'I' relates (identically in this case) the subject of the described circumstances to the speaker in the utterance.

The meaning of the sentence is not enough to determine the information conveyed by the utterance, but it does provide constraints on the range of information that can be conveyed.

Clearly, this view of meaning is radically different from that given by those semantic enterprises that view the meanings of expressions as set-theoretic objects that can be described independently of the uses of the expression, such as Montague semantics.

The mathematical framework that underpins situation semantics is provided by *situation theory*. This establishes a basic ontology of those entities that a finite, cognitive agent individuates and/or discriminates as it makes its way in the world: spatial locations, temporal locations, individuals, finitary relations, situations, types, and a number of other, 'higher-order' entities.

Situations are parts of the world that the agent individuates or behaviourally discriminates. *Types* are similarity categories across individuals, situations, and other objects in the ontology.

An agent can extract from one situation information about another situation, by means of *constraints*, abstract linkages between situation-types. For example, an agent who encounters a smoky situation may infer that there is a fire, by virtue of the constraint that links the type of those situations in which there is smoke to the type of those situations in which there is fire.

In the case where the first situation-type is that of an utterance, the relevant constraints include the meaning of the sentence uttered, and in this way situation semantics becomes a special case of a general theory of information flow.

Information about a given situation is taken to be in the form of discrete items known (following K. Devlin) as *infons*. In the simplest case, these are of the forms:

$$\ll R, a_1, \ldots, a_n \gg^+, \ll R, a_1, \ldots, a_n \gg^-$$

where R is an n-place relation and $a_1, \ldots, a_n$ are objects appropriate for R (often including spatial and/or temporal locations). These should be read as: the informational item that objects $a_1, \ldots, a_n$ do, respectively, do not, stand in the relation R.

An infon, σ, provides information about a particular situation, s, by virtue of that situation *supporting* σ, written $s \models \sigma$, meaning that the informational item σ is true of the situation s. At any given instant, an agent that encounters some situation, s, will be able to acquire just a finite collection of infons that describe that situation.

It should be emphasized that despite the common notation, this is quite different from the notion of model-theoretic truth defined by Alfred Tarski, that relates a model, M, to a first-order sentence, ϕ. Though also written as $M \models \phi$, in this case ϕ is a syntactic entity that has to be *interpreted* in M. Infons are semantic objects that require no interpretation.

A great deal of the current work on both situation theory and situation semantics involves the development of an appropriate calculus for handling the various items in the ontology. The construction of set-theoretic models of fragments of situation theory has led to renewed interest in non-well-founded set theory, and in particular P. Aczel's work on the 'Anti-Foundation Axiom' of set theory (AFA), since many of the objects that arise in situation theory and situation semantics involve self-reference.

A particular instance of this was provided by Barwise and Etchemendy's use of situation semantics to provide a solution to the age-old Liar Paradox. Their book on this topic, *The Liar* (1987), provides a gentle introduction to some of the features of situation theory and situation semantics, including the modelling using non-well-founded sets.

The 'standard' introduction to situation theory and situation semantics in its present state is Devlin's *Logic and Information, Vol. I.*

Barwise's 1989 book, *The Situation in Logic*, collects together all his own writings on situation theory and situation semantics since his original paper on this subject.

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KEITH DEVLIN AND SYUN TUTIYA

Situations

Ontology of situations is a semantic theory about the reference of propositions, in contradistinction to that of their syntactic parts, and of terms in particular. It states that – like terms – propositions have a reference, but what they refer to are 'situations', not things. Situations form an ontological category, and hence cannot be defined, only elucidated by postulates. Of these the most important are the identity conditions:

1. The reference of a proposition is not affected by exchanging one of its

clauses for another with the same reference.
2. Logically equivalent propositions have the same reference.
3. Propositions with the same reference have the same truth-value.

Condition 3. relates the concept of a situation to that of truth. In fact, the former is an offshoot of the correspondence theory of truth: propositions are true if they correspond to reality, and false otherwise. Now, in contradistinction to what is claimed by absolute monism, not the whole of reality is relevant to the truth-value of a proposition at hand, but only some part of it. A *situation* is any such part capable of establishing the truth of some proposition.

The idea that propositions have a reference of their own, on top of that of their terms, is an old one. It goes back to Plato's *Sophist* (236E–264B) where "Non-Being" is put forward as an answer to the question of how to provide for the reference of propositions which are false.

The same idea was discussed at length by the schoolmen of the 14th and 15th centuries as that of the *significatum propositionis*. Three views competed: Ockhamites took all propositions as having a reference, this being just an "arrangement of ideas" (*compositio mentalis*); Thomists believed only true propositions to refer, namely to the "plurality of things" (*plura*) referred to by their terms; and a third party held that reference was neither something mental, nor a set of things, but "the way a thing might be" (*modus rei*). Its main representative was Gregory of Rimini (*c.* 1300–58) who characterized it as "some way of being signified in a complex manner only" (*aliqualiter esse et complexe significabile*). The latter was the medieval counterpart of a situation.

Around 1900 the idea emerged again, independently, in Gottlob Frege and Alexius Meinong. Frege adopted for his references (*Bedeutungen*) also the converse of 3. the same truth-value implies the same reference. Hence his ontology of situations was minimal: there are just two situations, Being (*das Wahre*) and Non-Being (*das Falsche*). Meinong called his situations "objectives" (*Objektive*), opposing them to "objects" (*Objekte*) which are the reference of terms. They are related, however, by each object 'standing' in some objective and accessible to the mind through the latter only (*durch das Objektiv hindurch*).

The classic statement of an ontology of situations is Ludwig Wittgenstein's *Tractatus*. To every significant proposition (*sinnvoller Satz*) there corresponds a possible situation (*Sachlage*). If the situation holds (*besteht*), it is a "fact" (*Tatsache*), and the proposition is true. "Elementary propositions" are the logically simple ones; they describe "atomic situations" (*Sachverhalte*) which are "configurations of objects" indicated by names. Atomic situations are mutually independent (principle of logical atomism). The totality of situations is the "logical space" of language (*logischer Raum*), comprising not only the real world, i.e. the totality of facts, but all the possible ones as well. Each constitutes a "truth-possibility for the elementary propositions" (*eine Wahrheitsmöglichkeit der Elementarsätze*). Moreover, each proposition determines a "*locus*" (*Ort*) in logical space, consisting of those worlds in which the situation described holds.

Wittgenstein's ontology of situations admits of development and generalization. One attempt was R. Suszko's "sentential calculus with identity" (SCI) using an identity connective to state that two propositions refer to the same situation. Another was the axiomatic ontology of situations put forward by this writer. It is based on the primitive notions of an "elementary situation", and of a proposition being "verified" thereby. Elementary situations form a partial ordering, one "holding" in another, in which the greatest is the "impossible", and the smallest – the "empty" situation. Possible worlds are maximal consistent sets of elementary situations, with any two of the latter being consistent if both hold in some possible one. The 'situation' referred to by a proposition is defined as the set of all minimal elementary situations verifying it.

Recently two American authors (J. Barwise, J. Perry) have proposed a "situation semantics" bearing some resemblance to Wittgenstein's ontology of situations.

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BOGUSŁAW WOLNIEWICZ

Social Sciences

Two sorts of ontological questions can be distinguished:

(1) What characteristic features of reality correspond to judgements, propositions, or parts thereof?
(2) What, according to a given science, are the different kinds of entity making up reality?

A question of type (1) concerns the different categories whose availability makes representation possible, whether via thoughts and judgements or via the words and sentences of a language. It asks for a detailed description of these categories and the relations between them. Traditional metaphysics, as conceived by Plato and Aristotle, might be interpreted as trying to answer questions of this kind. Certain basic semantic features of judgements are taken to reflect categories in the world. Where some semantic features – like the distinction between subject and predicate – pervade an entire language, others are germane to particular kinds of sentences only. In particular, the semantic features of law-statements might be taken to reflect law-governed relationships – for short: laws – in the world.

A question of type (2) can be understood as relating to the ontological commitment of theories along the lines formulated by W. V. O. Quine ("On what there is", *Review of Metaphysics*, 1948). An answer to a question of this type has to specify the different kinds of objects posited in the scientific discipline at issue.

What we conceive as the tasks of the ontology of a scientific discipline depends, now, on whether we take 'ontology' to denote answers to (1) or to (2). If (1) is intended, then our ontology will concern the problem of whether the chosen discipline contains propositions or sentences whose special formal or material features force us to make special assumptions as to categories in reality. If (2) is intended, then ontology will concern the kinds of individuals which are quantified over by theories belonging to the discipline, and possibly the relationships between these different kinds of individuals.

Under the title 'social sciences' we subsume sociology, economics, political science, parts of psychology, anthropology, parts of ethology and sociobiology, and a number of different historical disciplines. We shall consider, first, whether the social sciences exhibit special peculiarities in regard to question (1). Second, with regard to question (2), we shall discuss the kinds of individuals or objects quantified over by theories and explanations in the social sciences.

Ontological Questions of Kind (1). Do empirical claims made in the social sciences involve more, or fewer, categories than do those of other disciplines?

In the social sciences one often finds that *beliefs* and *desires* are attributed to individuals. According to some authors (for example, Franz Brentano and his successors), this presupposes special relations in the world – so-called intentional relations. Thus, one category peculiar to the social sciences might be the category of intentional relation.

Sometimes it is claimed that the social sciences do not contain genuine law statements: where the natural sciences have natural laws for their subject matter, such laws play no role in the social sciences. The task of the latter is merely the description of empirical regularities (Donald Davidson). The absence of laws in their subject matter would thereby constitute a peculiar feature of the social sciences. On the opposite side is the view that the social sciences have to do with natural laws no less than do the natural sciences (John Stuart Mill, Carl Hempel,

Ernest Nagel). Such a view may concede that all law statements of the social sciences are probabilistic (Patrick Suppes). But this need justify no special status of the social sciences with regard to their ontology.

Do the facts studied by the social sciences differ in their nature from the facts studied by other disciplines? It is often held that a coincidence between the subject and the object of knowledge is a special feature of the social sciences. This leads to the claim that social reality is constituted by our attempts to get to know it, so that social facts would have a more subjective character than the facts studied by the natural sciences (Herbert Blumer, Harold Garfinkel).

Another view, in contrast, takes social facts to be epistemologically more basic than facts studied in the natural sciences. Social facts seem to be given in an unmediated way in the everyday or life-world ('*Lebenswelt*'). Hence natural facts might be secondary – their existence being made possible by our existence in the everyday world (Martin Heidegger).

Ontological Questions of Kind (2). We distinguish between *atomistic individualism*, which admits the existence of individuals (persons) only – groups and institutions are composed of individuals but they have no existence in their own right; to talk of them at all is just a *façon de parler* (Thomas Hobbes, Bernard Mandeville); and ontologies which assume the existence of social entities and divide into 'individualistic' and 'anti-individualistic' ontologies of the social world.

The *individualistic ontology of the social* comprises ideas of various authors, especially of David Hume (*Treatise of Human Nature*, III.ii.3), Adam Smith (*The Theory of Moral Sentiments*, II.ii.3; VI.ii.2), Max Weber (*Economy and Society*, Part 1, Chapter 1, § 1). The basic unit of this ontology is the *individual* or *person*. Individuals have attitudes of belief and desire and various kinds of emotions. Here, *social attitudes* are of particular importance. A social attitude is taken to be a psychological attitude in the content of which another person somehow plays a role. Given the existence of persons, and also the existence of social attitudes, we can specify identity conditions for special kinds of objects called *social entities*. Social entities are entities consisting of persons *and* social attitudes. Social entities differ with the different persons or the different social attitudes constituting them.

Different individualistic ontologies of the social will reflect different possible views of social attitudes and of psychological attitudes in general. On the one hand, psychological attitudes can be viewed as directed towards abstract objects, in which case such abstract objects are parts of social entities and contribute to their identity. This view is defended, e.g., by Heinrich Rickert, and it can also be encountered in phenomenological sociology (of Alfred Schütz) and in the work of Karl Popper (cf. his doctrine of the 'Third World'). We call this view *Platonist individualism of the social*. The opposed perspective (*anti-Platonist ontology of the social*) takes psychological attitudes to be directed either to sentences of a language or to tokens of mental representations or to complexes of objects in the world.

There are two different kinds of *anti-individualistic ontologies of the social*: the first may be called 'anti-individualism of the social as Big Person', the second 'anti-individualism of social systems'. Neither takes recourse to persons when specifying identity conditions for social entities. Individuals are not essential for the identity of a social entity.

Anti-individualism of the Big Person sort views social entities in analogy to persons – it takes them to be enlarged persons. This analogy licences the attribution of psychological properties to social entities: they have beliefs and desires, for example, just as persons do. The Big Person is taken as basic: individual human beings are derivative: their beliefs, desires, and actions are made possible only by or through the beliefs, desires, and actions of the Big Person. Especially in the 18th and 19th centuries, many thinkers adhered to this anti-individualistic perspective: for example in regard to *peoples* (endowed with the *volonté générale* of Jean-Jacques Rousseau), Marx's *classes* (endowed with class interests), the *nations* of historicism (endowed with character traits and various emotions) and *races* (J. A. Gobineau).

Connected with the Big Person view was the assumption of an analogy between social entities and organisms (e.g. in Carl von Savigny's historical jurisprudence).

The anti-individualism of social systems, in contrast, renounces the psychological analogy of social entities and persons; instead it concentrates on social attitudes. What is basic are the relations between bearers of social attitudes and their objects, i.e. other persons. But the view abstracts at the same time from the individuals constituting these social relations. Both the person who has the attitude and the person towards whom the attitude is directed drop out of the theory. Instead, the view considers only large networks of such attitudes and of the social relations determined by these attitudes. These networks contain as nodes social positions; and the paths between these nodes stand for social relations. A network of interlocking relations – a social system – is then taken as a social entity in its own right. The social attitude is thus no longer connected to specific persons and therefore loses much of its determinacy. In some ways it might be likened to the 'propositional functions' we know from logic. It contains dummy places which can be filled in any concrete case by individual persons. Prominent proponents of the anti-individualism of social systems are Emile Durkheim (*The Rules of Sociological Method*, 1895) and Talcott Parsons (*The Social System*, 1951). Durkheim, though, sometimes speaks of "social organisms" and Parsons also uses organismic analogies.

The individualistic ontology of the social acknowledges the existence of social entities. In this it does not differ from anti-individualistic ontologies. The difference is a matter of the different identity conditions for social entities: the identity of social entities for anti-individualism in no way depends on the individuals who happen to belong to the social entity in question; individualism of the social, on the other hand, takes individual persons to be essential for the identity of social entities.

Is there a way to decide between these different ontologies? Ontologies motivate research programmes in different disciplines and in turn are motivated by them. The explanatory and predictive success of research programmes linked in such a way to ontologies can be exploited for the evaluation of the respective ontologies. So-called *collectivistic* research programmes seem to imply anti-individualistic ontologies, whereas research programmes of *methodological individualism* – e.g. Austrian economics (Carl Menger, Ludwig von Mises, F. A. Hayek), individualistic sociology (George Homans, James Coleman, Alfred Bohnen), or the public choice approach in recent political economy (James Buchanan, Gordon Tullock) – go hand-in-hand with individualistic ontologies of the social. Methodological individualism seeks to explain social facts by means of individualistic social entities. Collectivist research programmes, on the other hand, recommend the use of anti-individualistic social entities (Big Persons, social systems) in explaining social facts.

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HORST WOLFGANG BOGER AND AXEL BÜHLER

Soto, Domingo de

Domingo de Soto was born in Segovia *c.* 1494/5 and studied in the Universities of Paris and Alcalà. He taught logic in Alcalà and Burgos and theology in Salamanca. He died in Salamanca in 1560. As an influential member of the Dominican Order, Soto was deeply involved in politics: he was a teacher of Philip II, the confessor of Charles V, and an active delegate to the Council of Trent. He made important contributions to a plurality of fields, so much so that it was said that '*qui scit Sotum, scit totum*' (who knows Soto, knows everything). Particularly relevant is his work on the philosophy of law and politics: the *De*

Iustitia et iure (Salamanca, 1556), which went through some thirty editions before 1600 and is still considered a classic. In this work, Soto attributes a relative autonomy to law: although ultimately derived from God's authority and from natural law (which is a divine light given to human reason), the *ius gentium* is for him a form of positive law.

Soto's philosophy is Thomistic, but it shows some influence of Scotism and nominalism, especially in the first edition (Burgos, 1529) of his *Summulae* – a commentary on the *Summulae Logicales* by Peter of Spain (*c.* 1210/20–77). In the second edition (Salamanca, 1539), Soto added a treatise on terms, and modified many of the positions he had previously adopted. He gives also an apparently Ciceronian definition of dialectics, considered as the art of discussing *probabiliter*. As Risse (1980) remarks, however, this should not be considered as a rhetorical attempt to establish apparent plausibility, but rather as an attempt to establish rational assertibility. Among the interesting points of the *Summulae* are the treatment of *inductio* in terms of *ascensus* (the passage from a conjunction of singular propositions – or from a proposition with a copulative term as subject or predicate – to a universal proposition, or to a proposition with a general term as subject or predicate), and a complex square of modalities, which takes into account the quantity of the subject.

Soto's general views on logic are clearly presented in his *In Dialecticam Aristotelis Commentarii* (Salamanca, 1543), where he defends the necessity of dialectics, while criticizing the 'abstract sophistries' of the late scholastic logical tradition. Logic is here considered a speculative science *simpliciter et absolute*, and at the same time as an art *quodammodo* (in some way); its object is, following the Thomistic tradition, the *ens rationis*. As for the problem of the nature of universals, Soto criticizes the view, which he ascribes to Paul of Venice, that universals are *in rebus* independently from the operation of intellect; for him, in order to have a universal *in actu* it is necessary to perform an abstraction. Also interesting is his theory of higher-level predicates (*secundae intentiones*) (see Hickman 1980).

Soto defends the theory according to which the same formal concept of being is said analogically of both substance and accidents, and of both God and creatures. He also refuses the Thomistic theory of the real distinction between essence and existence, by denying its centrality for Thomas Aquinas's system ("It is not so important to admit or to deny this distinction", *In Dial. Arist.* V,1). As for the theory of knowledge, he maintains that the immediate object of human understanding is indeterminate being, thus showing a Scotist influence. His psychology accords intellect a priority over will.

Deeply involved in the post-Reformation controversies, Soto criticizes the Protestant conception of justification in the *De Natura et Gratia* (Venice, 1547).

Attention is also paid today to Soto's work on physics; in the *Super libros Physicorum Quaestiones* (Salamanca, 1545), where he appears to be acquainted with the results of the Mertonian School, Soto applies advanced methods to the problem of falling bodies. Duhem (1913) saw in Soto a precursor to Galileo, an interpretation which has been discussed by Marshall Clagett and Alexandre Koyré. W. A. Wallace (1968) gives an accurate presentation of the question, and concludes that

> Soto's uniqueness . . . consists in having introduced as an intuitive example the simplification that Galileo and his successors were later to formulate as the law of falling bodies.

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GINO RONCAGLIA

Soul

'Soul' in the wider sense is understood as referring to that in virtue of which living things are alive (principle of life), in the narrower sense as referring to the *bearer* of conscious mental states. On the dualist account the whole man has the properties he has because his constituent parts, body and soul, have the properties they do. The dualists, including René Descartes, claim that the soul is the essential part of the person whose continuity (identity) alone makes for the continuity of the person. Extreme dualists tend to think of the soul as a separable immortal spiritual substance.

The soul as separable entity finds emphatic expression in the dualism of Plato. The user and the thing used, Plato argues, are always different. Since I *use* my hands, my eyes, my whole body, it follows that what I am as a person is not my body, but my soul (*Alcibiades* I). The soul has pre-existence and it is immortal. I possess some knowledge and certain ideal concepts (e.g. the concept of perfect equality) which I cannot have acquired in this life (*Meno*). The soul must therefore have acquired knowledge or have been acquainted with ideas before this life began. I can further survey the invisible, unchanging, and imperishable 'Forms' (*Phaedo*). Coming into contact with the Forms, the soul must thus be more like them than like corporeal reality. Its immortality is a consequence of its uncorporeal, *uncompound*, and deiform nature. Plato's doctrine of the tripartite nature of the soul (*Republic, Timaeus*) as consisting of rational (λογιστικόν), courageous (θυμοειδές), and appetitive (ἐπιθυμητικόν) 'parts', does not necessarily clash with the thesis of the soul's indivisibility, for 'part' (μέρος) can be interpreted in a metaphorical sense. The source for this tripartite conception might be the frequent experience of rival springs of action within man.

Aristotle's fundamental thesis is that the soul is the 'form' of the particular living body. The Aristotelian notion of form seems therefore to leave no room for the Platonic doctrine of immortality. The soul as 'form' is the vital principle in a living thing; it is the 'ἐντελέχεια' or '*actus*', i.e., the actualization of the body. The soul thus conceived is inseparable from the body, though some residual Platonic elements survive in Aristotle's doctrine of the rational or intellective soul. Whereas Plato seems to suppose that any soul can fit itself into any body (transmigration of souls is possible), Aristotle holds that every body has its proper distinct form.

Aristotle distinguishes form, matter, and the 'composite', the last of which is the actual thing, the 'primary substance'. To speak of form and matter is to speak of the form and the matter of such an actual thing. The form depends on and refers to the structures, functions, powers, and the like which a primary substance has. The form of a house, for example, is its ability to give shelter. What makes a body an animal or a man is its having ψυχή, i.e., peculiar functions and powers, just as sight is what makes it true that an object is an eye. Form and matter are not 'constituents' in the ordinary sense. Thus no question arises as to how they combine into a unity. The mind–body problem and the question of how soul and body interact are not issues for Aristotle.

In *De Anima* (II, 1) Aristotle defines the soul as "the first actuality of a natural body that has life potentially or that has organs". To be a body with organs is to have certain powers – nutritive, perceptual, locomotive, etc. The actualization of any of these powers is "second actuality". Aristotle calls the soul "*first* actuality" to make it clear that it is the principle of life which a living creature has even when completely dormant, the possession of a power not being the same as its exercise.

The human soul unites in itself the powers of the lower vegetative and sensitive souls, and has the peculiar advantage of possessing 'νοῦς', i.e., the power of scientific thought (ἐπιστημικόν) and deliberation (διάνοια πρακτική). Whereas all the other powers of the soul are inseparable from the body and perishable, the active intellect, essentially actuality or divine, is however separable, unmixed and, therefore, eternal (*De An.*, 5).

Immortality is central to the Christian approach to the soul. Mental activities clearly

presuppose for Thomas Aquinas a principle which has to be independent of the body, indivisible and, therefore, immortal. The human soul is capable in principle of knowing everything: it is "*quodammodo omnia*" (*Sum. Theol.* I, 14, 1, c). Aquinas defines the human soul as "*forma substantialis in se subsistens*", i.e., form which is capable of existing on its own without a body. Aquinas and scholastic philosophy after him is not dualistic in the strict sense. For the soul is not a substance proper, even though it is a "*hoc aliquid*", i.e. something which is more than mere form yet not complete "*in se*".

Through Descartes dualism received a new formulation. His postulate of the soul as "*res cogitans*", which is independent of physical reality as "*res extensa*", made possible modern philosophies of consciousness including the whole tradition of German idealism. The new Cartesian point of departure in philosophy became the certainty, the '*fundamentum inconcussum*', that I exist. The existence of the '*ego*', '*mens*', or '*anima*' is for Descartes far more certain than that of sensible objects. Even given the hypothesis of the evil genius I cannot doubt my own existence without affirming it. I am a thing which doubts, understands, affirms, denies, wills, and also imagines and feels (*Meditationes* II). I derive the general idea of substance from being aware of myself as unity.

For Leibniz the soul is the *dominant monad* 'in' the organic body which it dominates. As monad it has no parts, extension, figure, or divisibility. It cannot come into existence in any other way than by creation and cannot perish in any other way than by annihilation. Souls which enjoy apperception are rational souls or spirits. In so far as the soul has distinct perceptions and apperceptions it is active, and in so far as the monads composing the organic body have confused perceptions they are passive. In this sense the soul is said to dominate the body. Souls act according to final causes, ends, and means. Bodies act in accordance with the laws of efficient causes. The realms of final and mechanical causality are in harmony with each other.

Even if Franz Brentano sought to establish psychology on an empirical base, he still accepted its characterization as a science of the soul (*Psychologie* I, 8), understanding soul as the substantial bearer of mental phenomena, i.e., of those phenomena which are intentionally directed toward objects. To conceive intentionality as the distinguishing mark of the mental is not Brentano's own invention, but is taken by him from the Aristotelian scholastic heritage. Brentano stresses the *unity* of consciousness – which does not, however, imply total simplicity. The unity of consciousness is compatible with the plurality of 'parts' or states of one and the same subsistent thing or substance.

Discussion of the soul seems to have been brought to a temporary halt by Gilbert Ryle's (1900–76) attack on dualist conceptions of the soul as a "ghost in the machine" (*The Concept of Mind*, 1949). The notion of the soul as substance is said by Ryle to reflect a mere category mistake. Philosophical discussion about the soul and its ontological status has not, however, ceased. In contemporary philosophy of mind the classical problems of the soul have come to the fore once again.

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EDMUND RUNGGALDIER

Soviet Philosophy

Traditional Soviet Ontology. According to the Soviet philosophical tradition, materialistic dialectics is a science of being *qua* being. Since *c.* 1965 ontological problems have been treated in relation to the forms of *practice* of individuals and societies. Because practice involves both goals and reasoning, the forms of practice also include certain forms of cognition and acquisition of knowledge. In this sense the analysis of knowledge is automatically an ontological enquiry. Thus the problem of categories has dominated the investigations of Soviet philosophers from 1960 to 1980. The results of these invest-

igations concerning the nature and origin of the categories are:

1. Categories are the forms of human social practical activity. They are forms of being and at the same time the social forms by which man reflects reality.
2. Categories are a product and also a condition of a society's development.
3. Categories have two sides representing things and operations.
4. Categories have a two-fold origin: the process of labour and social communication. Practical use of categories precedes their theoretical understanding. (This is based on the work of the Soviet psychologist Lev Vygotsky (1896–1934).)
5. There are three types of categories: particular scientific categories (e.g. of special empirical sciences); general scientific categories (which are used in different theoretical sciences, for example categories such as *structure, system, information*); and non-scientific categories (e.g. the categories of philosophy).
6. There are three corresponding levels in the analysis of being: empirical ontology (relating e.g. to the *Gestalten* of vision and perception); theoretical ontology (relating e.g. to systems of reference in physics); and cultural and historical ontology (relating e.g. to the analysis of myths).

Ideas along these lines were developed by Michail Bulatov (born 1936), Vladimir Gott (born 1912), Aleksey Losev (1893–1988), Sergey Krimsky (born 1930), Miroslav Popovich (born 1930), Natalia Viatkina (born 1953), and others. Traditional ontology has shown little interest in problems such as the being of consciousness, the problem of human existence, and the problem of universals.

Non-traditional Soviet Ontology. Investigations in the problem of consciousness beginning in 1970 were inspired by German, French, and Italian existentialists and neo-Marxists. The general results of these investigations are:

1. Man, the world, and their relations exhaust the realm of being.
2. Material social practice is the fundamental mode of human existence: creating the conditions of this being, man thus produces and reproduces himself together with his relation to the world.
3. The subjectivity of practice is the real basis of consciousness.
4. The nature of subjectivity consists in its relation to everything else.
5. The phenomenon of consciousness has a two-dimensional structure. The first dimension is ideological in the sense of Marx, so that there is no such thing as presuppositionless consciousness. The second is factual, so that the activity of consciousness is articulated in objective social structures. This is expressed by Marx's interpretation of social phenomena as a part of the natural-historical process.

Non-classical Action Theory. Generally action is not governed by personal goals and reasons but is articulated in objective social structures. Thus for example ritual actions do not reflect the world but symbolize it, giving a rational perspective to the flux of experience and translating the general flux into stable objects. In this way man understands reality, the rituals serving as a basis for the idea of objective or mind-independent law in society and culture. They are means by which man constitutes himself *qua* man.

These ideas were developed by Vadim Ivanov (born 1933), Merab Mamardashvily (1930–90), and others.

The Problem of Universals. Investigations in this area were inspired by the tradition of analytic philosophy and began around 1980. Subjects of research are for example conceptions of modal realism, the doctrine according to which the being of universals is grounded in the really possible or in real possibilities. Following the Aristotelian tradition, the modal realists postulate that possibility is the mode of being of the universal – so that for example *humanity* would be the structure of possibilities of each individual man. To be a realist in the sense of

accepting the reality of universals means to acknowledge modalities *de re*.

Structure (εἶδος, μορφή), an ontologically neutral entity, occurs as a particular or as a universal. A structure becomes a universal if a particular exists which has this structure as the structure of its possibilities. The actual existence of one particular can open up new possibilities to other particulars and thus confer existence upon new universals.

Words have meaning because they refer to universals. Thus the meaning of a word is the structure of possibilities of a relevant particular. Analysing the meaning of a text in this manner, we must interpret language, too, as a structure in the sense of a second-order universal. It then not only describes the world but also represents it *qua* structure. Representation is a real relation: structure represents that particular which can turn it into a universal.

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VALENTIN OMEL'YANCHIK

Space-Time

Philosophical puzzles about the nature of space and time are, of course, ancient. Augustine presents us with the paradoxes which arise when one considers that past and future existents do not, properly speaking, exist, but that the present is a vanishingly small instant of being. Plato and Aristotle can, without too much anachronism, be taken to initiate the debate between those who view space as a substantial entity and those who take it to be merely a collection of relations among material particulars. Plato also emphasizes the special epistemic status of geometry, its nature as what Kant later called a collection of truths both synthetic and *a priori*. The idea that spatio-temporal notions can be defined in terms not explicitly spatio-temporal, most particularly in causal terms of one sort or another, traces back at least to Leibniz.

The necessity of taking into account the best available non-philosophical work on space and time when formulating one's philosophical doctrines is also evident far back into the history of the subject. Plato and Aristotle relied on the newly discovered axiomatic geometry and the speculative cosmology of their time. The great 17th- and 18th-century philosophers, from René Descartes to Kant, found it necessary to take into account the accomplishments of the scientific revolution, particularly the discovery of Newtonian mechanics, in developing their philosophical doctrines of space and time. So it is no surprise that contemporary philosophical work on space and time requires a comprehensive grasp of the results of recent physics, in particular of the theories of special and general relativity, in order to construct plausible philosophical responses to characteristically philosophical questions.

The Special Theory of Relativity, as usually formulated in Minkowskian terms, integrates space and time into a new basic entity, space-time. Space and time themselves are only recoverable relative to a particular state of motion of an 'observer', a recoverability not always possible in some of the models of space-time allowed by general relativity which prohibit a global decomposition of space-time into space and time because of their unusual topology. In any relativistic space-time the class of events which are 'present' relative to a given event also varies from observer to observer. This is frequently taken as conclusively refuting the Augustinian doctrine noted above, as well as later theories of time which emphasized the radical metaphysical distinctness of time and space, such as the account of time in Henri Bergson. But careful reflection on what relativity actually says, and on the fundamental facts on which it rests, have led others to maintain that the new theory is compatible with, or even supportive of, the Augustinian and Bergsonian themes.

Our naïve and intuitive ideas about the nature of time order suffer even greater blows when possibilities allowed in general relativity are admitted. There are general relativistic worlds with 'closed timelike lines', i.e. collections of events which can constitute the life-history of a material being which 'return' to the initiating event in time as one moves from event to later event. Even more disturbing are so-called 'time non-orientable' space-times in which no global distinction between past and future direction of time can be consistently drawn. The possibility of such worlds suggested by this new physical theory certainly diminishes the appeal of claims to the effect that some feature or other of time (or space) is 'necessary' in nature.

The varied possibilities for space-time allowed by general relativity also make quite dubious claims that geometric truths can be known to be true *a priori*. But the characteristic of the theory which consists in its asserted content outrunning that which is experimentally determinable leads to a type of resurrection of *a priorism* in the form of the allegation that our choice of geometry is a matter of convention or stipulation on our part. A similar opening for conventionalism already arises in the foundations of the special theory of relativity when one notices the necessity of posits not immediately experimentally grounded but which must be made in order to derive the standard consequences of the theory. Obviously these epistemological questions about the theory (for example, whether it is or is not 'true by convention') are intimately connected with questions concerning the 'reality' of the theoretical entities and features attributed to the world by the theory.

With the discovery of special relativity, early philosophical investigators frequently claimed that modern physics had finally vindicated relationism as opposed to substantivalism in the theory of space-time. Later it was realized that the arguments adduced by Sir Isaac Newton for substantivalism were paralleled by similar arguments in the special relativistic context. The general theory of relativity was thought by Albert Einstein to vindicate Ernst Mach's version of relationism, but this hope also proved to be unjustified by the facts about the theory uncovered by later philosophical work. Since general relativity treats space-time as a dynamical entity with its own mass-energy, some philosophers think it provides a stronger case for substantivalism than did Newton's absolute space. The interpretations of general relativity which try to derive all matter as curved space-time ('geometrodynamics') tend even further in this direction.

On the other hand, careful philosophical analysis tends to show that many of the arguments in favour of relationism can be reconstructed also in the special and general relativistic context. Overall it seems fair to say that neither special nor general relativity in and of itself determines the correct philosophical stance in the substantivalism-relationism debate. The terms of the debate become modified and the necessity for bringing implicit philosophical assumptions to the surface becomes emphasized, though, when one updates the traditional philosophical controversy in such a way as to do justice to the new scientific results.

Since Leibniz there has been a recurring argument to the effect that it is the structure of causal relations among events which constitutes the structure of spatio-temporal relationships. Sometimes it is alleged that a feature of space-time not causally definable is *a fortiori* only a conventional feature. Sometimes it is claimed that features are real or intrinsic to space-time only if they can be causally defined or reduced to causal relationships. The fundamental roles played by causal connectibility and non-connectibility and by the notion of a continuous causal path have encouraged many to advocate such causal theories of the nature of space-time structure.

But the critical investigation of such 'causal theories of space-time' reveals many complexities and subtleties. There are a variety of causal notions which might be taken as fundamental. There are a variety of senses in which a space-time concept can be said to be definable by a causal concept. And the inference from definability or non-definability to claims of conventionality or of genuine 'reality' or non-reality for a space-time feature is fraught with presuppositions easily hidden from view.

While simultaneity is sometimes said to be conventional in special relativity because it is 'causally indefinable', there are interesting senses in which simultaneity, indeed in which the entire metric structure of Minkowski space-time, is causally 'definable' in the special relativistic context. In general relativity the causal structure of the world can take on quite pathological forms, given such possibilities as causal curves which are closed or causal curves which, if not properly closed, are convertible into being closed curves by infinitesimal changes in the space-time structure. Features of space-time which are 'definable' in terms of some causal features in non-pathological space-times, are not so definable in space-times which have causal pathologies intrinsic to them. Yet other varieties of causal 'definability' work in all space-times, whether pathological or not.

The wide variety of concepts of causal definability suggests, and suggests correctly, that any attempt to draw important metaphysical/ontological theses from the causal structures necessitated or allowed by a physical theory of space-time will require a careful philosophical analysis of the causal notions involved, the notion of definability used, and the relevance of these to the ultimate philosophical conclusions drawn.

Finally there remains the interesting if still controversial attempt to found in some way the intuitive asymmetry or directionality of time on a feature of the world not intrinsically spatio-temporal in nature, that is on the asymmetry of systems in their one-way progression from ordered to disordered states (i.e. on the alleged non-decrease property of entropy in thermodynamics and statistical mechanics). Once again important results of modern physical theory (especially in statistical mechanics) play a crucial role in the debate, but the philosophical issues involved are still quite obscure and much remains to be done in explicating the claims being made in order that progress in resolving philosophical disagreement can be made.

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LAWRENCE SKLAR

Species, Genus

In most European languages, the Latin words *genus* and *species*, and some derived terms, are used with both a philosophical or scientific meaning and a popular one, most often to designate groups of objects possessing certain similarities with one another. Yet, from the very beginning, the two words had been considered as equivalent to the Greek terms *genos* (γένος) and *eidos* (εἶδος). First, they retain the same etymology: *genus*, like γένος, derives from verbs meaning 'to come into being, to be born', and indicates an identity of origin. *Species*, as well as εἶδος, on the other hand, indicates the visibility or even the lustre of things which can then be classified together because of their similar appearances. That is the meaning of γένος and εἶδος in the *Iliad*, where γένος, however, designates the birth and the origin as well as the whole group of individuals having a common origin. The two words also retain the same semantic range as their Greek forerunners, with the exception of the Aristotelian technical meaning of εἶδος as 'form' (versus 'matter') which in Latin and medieval times was not expressed by the word *species* but by the word *forma*. Later philosophical meanings of γένος and εἶδος are already attested in the writings of the pre-

Socratic philosophers, but Plato and Aristotle gave them their 'technical' meanings, thus originating the philosophical and scientific problems which have been attached to these terms ever since.

The words γένος and εἶδος have no taxonomic function in Plato: they do not refer to rigid classificatory units and are more or less interchangeable in the divisions of the *Sophist* and the *Republic*. The remarkable thing, however, is that the two words (and especially εἶδος) can be used to denote classes of things and also a superior, intelligible reality ('idea'). Concurrently, it is implied that a dialectician can, and even must, discover the articulations of reality itself by dividing its instances into γένη and εἴδη. In this respect, Plato already considered that γένος and εἶδος indicated real groups. Aristotle also used the word εἶδος to refer to the intelligible aspect of reality (the 'form'). It is, however, the Aristotelian conception of the relations between γένος and εἶδος which is the origin and the theoretical foundation of the problems which have been attached to the pair genus-species.

Among the properties ascribed by Aristotle to the pair γένος-εἶδος, we may stress the following:

1. They can be used to designate classes of objects of a very different nature and to establish the *definition* of the members of the said classes, that is, to reach 'the formula of their essence'.
2. The *genos* can be divided into εἴδη and, hence, although γένος (and consequently εἶδος) do not refer to any fixed classificatory level, γένος always precedes εἶδος logically.
3. In a γένος the εἴδη are 'contraries', which means that they cannot coexist in a single subject while being opposed to one another in a determinate way. Hence, their opposition is stronger than that of relatives (something's double is not 'contrary to' its half), but weaker than that of possession/privation (winged/wingless) or that of contradiction (he sits/he does not sit). Thus, the γένος 'colour' has black and white for its εἴδη. It must be stressed that some contraries imply intermediate objects (between black and white one can posit all other colours), while some do not accept any (for instance, illness and health). Furthermore, one term can have contraries in various ways: the golden mean (virtue) is contrary to excess and to defect. In the field of biology, Aristotle used the pair γένος-εἶδος to define the 'parts' of animals rather than their kinds: the γένος 'stomach' can vary according to its shape (elongated/shortened), its size (big/small), and its position (high/low).

Of these three properties of the pair γένος-εἶδος, the tradition most often retained the first and the second. This is most obvious in the *Isagoge*, a small treatise by Porphyry, which became the foundation of the teaching of logic in the Western world during the whole of the Middle Ages. The function of what has been called 'Porphyry's tree' was precisely to establish a series of particularizing divisions that, starting in an all-embracing kind and descending to an ultimate specific one, provides the logician with a definition applicable to the individuals belonging to this kind. For instance, the successive divisions: incorporeal/corporeal substance → non-living/living things → not animal/animal → irrational/rational → immortal/mortal, produce the definition of man as a 'rational mortal animal'.

The main metaphysical disputation which has arisen about the pair genus-species between antiquity and the present day, and with special vigour during the Middle Ages, is that which opposes the 'realists', who hold that genus and species have a reality of their own, to the 'nominalists', who think that they are merely objects of thought or names in virtue of the thesis that real existence can only be ascribed to individual things.

However, the main event which has affected the history of the pair genus-species did not originate in the field of metaphysics, but in that of biology. The two Latin words *genus* and *species* and their equivalents in modern languages have been, since the 16th century, principally used, and later almost exclusively used, to classify botanical and zoological families. This usage is a new one

and the tradition which ascribes to it Aristotelian antecedents is not really acceptable. Thus, contrary to what is quite often written nowadays, Aristotle does not use εἶδος to designate any animal species. The new usage first led naturalists to ascribe to genus and species a fixed position within a taxonomic scale, and then to confer on species a privileged position. Thus all agree in counting species as real (or natural) classes which do not owe their existence to human intervention, whereas kinds are sometimes considered as groupings produced by the classifying activity of our minds.

This typological conception of species, originally morphological, has rapidly become transformed into a conception based on genetic relationships; similarities of structure between members of a species have yielded precedence to their mutual fertility. Against Linnaeus (1707–78), who considered a species as a collection of similar individuals, Georges Buffon (1707–88) defines the species as "a stable succession of similar, interbreeding individuals". This definition leads him to support the thesis according to which the species have a stronger ontological consistency than the individuals do:

> An individual, of whatever species it might be, is nothing in the universe; a hundred or a thousand individuals are still nothing. The species are the sole beings in Nature.

The end of the theory of the fixity of the species was not, as Charles Darwin (1809–82) probably believed at a certain time, the end of the notion of species. Species merely acquired a history. The development of genetics and in particular of the theory of population genetics (a population is the collection of interbreeding individuals living in a relative reproductive isolation; a species generally contains several populations) have recently modified the purely biological approach to species as they have taken into account the extreme variability of the individuals constituting the species, a variability which is due to genetic mutations as well as to the reactions caused by the pressure of an ever-changing environment. Species, however, in spite of all their mutability and liability to various modifications, remain a stable reality in the eyes of modern biological research.

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Speech Acts

Speech act theory is commonly held to date from the William James Lectures given at Harvard University by J. L. Austin (1911–60) in 1955 and published posthumously in 1962 under the title *How to Do Things with Words*. Here Austin tries to describe linguistic utterances as performances of socially relevant acts subject to or in fact constituted by certain "felicity conditions", i.e. conditions under which they are performed successfully. Austin's disciple John R. Searle, in his book *Speech Acts* (1969), advanced a modified theory which adds elements of a theory of meaning to Austin's original theory of language use. Like Austin, Searle held that utterances are means of executing such linguistic acts as asking, warning, or promising. They therefore convey not only propositional content but also so-called "illocutionary forces". These 'forces' are defined in terms of the conditions that must be fulfilled for the adequate use of an "illocutionary force indicating device" such as the "performative" verb *to promise* which, used in the first person singular, indicates that a promise is being made by the speaker. Among these act-defining conditions are pragmatic rules concerning the relevant situational features, the 'sincerity' of the speaker, and the appropriate semantic content of the relevant proposition. Searle holds these rules to be "constitutive" for the historical formation of the act-types and for the successful execution of the respective illocutionary acts.

Austin and Searle put forward different analyses, but then agree with regard to the main components of a speech act, namely:

1. the "locutionary" (Austin) or "utterance act" (Searle)
2. the "illocutionary act" (the linguistic action performed) and
3. the "perlocutionary act" (the effect on the hearer intended thereby).

For Austin the "locutionary act" is tripartite: it consists of a "phonetic act", i.e. the act of producing certain noises, a "phatic act" of uttering words as conventional noises of a certain form which belong to a certain vocabulary and are structured in accordance with a certain grammar, and a "rhetic act" consisting of "reference" and "sense" (predication). Searle's main contribution to the analysis of the component structure of speech acts consists in his insight that the action-type itself imposes certain requirements with respect to the nature of the propositional content involved. Thus the "propositional act" is internally related to the illocutionary force which it comes to be associated with. The act of promising, for example, requires that the speaker predicate to himself as the subject of the proposition some future action (an action which is allegedly in the interest of the hearer). A request, in contrast, implies that the subject of the proposition be the hearer. Both action-types share the feature that the 'propositional content rule' requires a logical future for the action being promised or asked for, but they differ as to the agent of this action.

The main problem of speech act theory has been the analysis of the so-called 'indirect speech acts' in which the illocutionary indicator and the intended illocutionary force differ: I can *threaten* someone by *promising* to give him a good thrashing; I can *assert* something by means of a (rhetorical) *question*; I can *ask* someone to pass me the salt by *asserting* that I need it or by *asking* whether he 'would' or 'could' pass it to me. And I can *request* that the door be closed by simply *asserting* that it is draughty.

An approach to linguistic utterances and their uses similar to that of Austin and Searle had been advanced already by phenomenological philosophers before World War I, though their work was thereafter neglected. Fifty years before Austin's allegedly epoch-making discoveries, the German phenomenologist and philosopher of law Adolf Reinach, a student of Theodor Lipps and disciple of Edmund Husserl, published a monograph *Die apriorischen Grundlagen des bürgerlichen Rechts*, in the first volume of Husserl's *Jahrbuch für Philosophie und phänomenologische Forschung* in 1913. Here Reinach develops a theory of what he calls "social acts" in which he tries to formulate the essential properties of action-types involving uses of language, paying special attention to the phenomenon of promising. The Scottish philosopher Thomas Reid, too, had earlier used the term "social act" in his work on act-performing utterances, but Reid did not succeed in deriving a complete theory from this insight.

Metaphysical Implications. Though conceived as part of the analytic movement in philosophy in a period when this movement still embraced clearly anti-metaphysical leanings, the theory of speech acts yields certain metaphysical implications:

1. *Forces.* Mainstream speech act theory, i.e. Austin, Searle, and their followers, though rightly noticing that utterances can serve as a means of performing social actions, has conceived the action performed by an utterance in terms of a 'force' underlying it or conveyed by it. Thus, it has described the 'illocutionary force' of an utterance as a hidden entity somehow added to the utterance by the speaker and, in the ideal case (which was also taken to be the normal one), gathered from it by the hearer. This conception has been called the "ontological fallacy" of speech act theory (Burkhardt 1986) and a "case of language magic in linguistics" (Hermanns 1985). It is caused by confusing linguistic act concepts with linguistic action.

2. *Apriorism.* Searle distinguishes between natural or "brute facts" and social or "institutional facts", and between "regulative rules" which regulate independently existing interpersonal relationships and "constitutive rules" which (like the rules of football or chess) create and then regulate a certain

activity. He claims that speech acts are governed by rules of the latter kind, i.e. they are conventional institutional actions produced by the respective infrastructure of human societies. As Reinach had already pointed out, however, this would imply that we could conceive linguistic action types in whatever way we regard as useful, that we would be free to combine any set of features, fix them by corresponding conventions and thereby constitute new illocutions. Consider, however, the example of a promise: how could the necessary features of a promise be other than they are? Could we really cancel the feature of its creating an obligation in the speaker, for example, or change the required (future) tense of the proposition uttered and put the addressee in subject position? According to the Reinachian 'aprioristic' view, certain acts are of such simplicity and naturalness that they could not have been created by constitutive rules. They are convention-independent structures, as it were, waiting to be actualized by given societies. Under the premiss that there are intelligent social creatures, some act could not be a promise unless it has the properties of announcing a future action of the speaker which he has the will to carry out, which is assumed to be in the interest of his addressee, and in such a way that the announcement is intended to bring about an obligation.

3. *Ethics*. The ethical problems involved in certain kinds of speech acts were noticed only rarely. Though the act of promising was generally taken as the prototype of linguistic action and used as the starting-point of almost all investigations, the ethical 'force' of social acts in creating claims and obligations was hardly taken into consideration. Again, Reinach is an exception here, his theory of promising resting, for example, on the model of a hierarchy of ethical values and on the thesis that, although there is a general duty to keep one's promises, still there are higher ethical values (such as the duty not to kill) that may contextually suspend the obligations our promises create. Searle's notorious derivation of 'ought' from 'is' in Chapter 8 of his *Speech Acts*, i.e. his thesis that an obligation flows from the mere institutional fact that a promise has occurred, seems, in contrast, to do less than justice to the different ethical dimensions of the phenomena in question. Some problems simply may not be solved non-metaphysically.

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ARMIN BURKHARDT

Spinoza, Benedict (Baruch)

Benedict or Baruch Spinoza (1632–77), a Dutch Jew of Portuguese descent, set forth his monistic metaphysics in his *Ethica*, published just after his death. For Spinoza there is just one substance which may be called either God or Nature, for it answers to the implications of either word. Thus it exists necessarily, is in some sense perfect, and is an appropriate object of religious emotion, while all natural phenomena are processes within it. All other things are 'modes' of the one substance. Thus the existence of a finite thing like a person or tree consists in the fact that the one substance is qualified in a certain way. All this Spinoza professed to prove very roughly as follows.

1. The essence or nature of a substance is constituted by its 'attributes'. Now a substance specified as possessing all possible attributes must exist. (a) For anything which either does or does not exist must do so either of its own nature, thus necessarily, or through the agency of something else. (This is the point most likely to be challenged by modern critics.) In the case of a substance with the richest conceivable essence it would be absurd to suppose that its existence or non-

existence was externally determined, so a substance with an infinitely rich essence either must exist or must fail to exist of its own nature. But to suppose that an infinitely rich nature *stopped* a thing existing would be absurd, so the substance with the maximally rich essence must exist *necessarily*. (b) Moreover, we know empirically that something exists. Now granted something exists, then something must exist of its own nature, else the existence of every single thing would be determined by the existence of something else and there would be no explanation of why anything existed at all. But granted that *something* exists of its own nature, it would be absurd if the thing with the richest nature did not. This necessarily existing substance with the richest conceivable essence is God or Nature.

2. The next thing to be shown is that God is the *only* substance. Now one thing is distinguishable from another thing either by its essence (what it essentially is) or by its modes or accidents (what it does or suffers) for all truths about a substance must concern one or other of these. However, one substance cannot be distinguished from another solely by its accidents, for they must be distinct 'already' to do or suffer different things. (This oddly anticipates later arguments for 'bare particulars' which cannot be distinguished from each other merely by their properties for they must 'already' be different if they are to have different properties. But for Spinoza it is substances, each the actualization of its own unique essence, rather than 'bare particulars' which are in question.) So any two substances must have distinct essences. Now we have seen that there is a substance with an essence comprising all attributes, therefore no other substance could be distinguished from it by its possession of a different attribute, for God possesses all attributes. It follows that there cannot be another substance, since substances cannot be distinguished by their modes.

An objector may well ask why the distinction between God and another substance sharing an attribute with him may not rest on the fact that the other substance lacks attributes which God possesses. Spinoza needs another axiom or theorem here to the effect that there cannot be essences constituted by partly, but not wholly, the same set of attributes. And, in fact, he had the resources to establish this. For he has defined an 'attribute' as 'what the intellect perceives of a substance as constituting its essence' and could argue that there could not be two essences such that the same attribute might be conceived as constituting either. So, since one attribute in common applies all attributes in common, and since God necessarily exists with all the attributes, there cannot be any other substance.

Spinoza holds that although there is an infinite (in what sense has been disputed) number of attributes constituting the essence of this one substance, we know of only two, thought and extension. The precise sense in which for Spinoza an attribute is what the intellect perceives as constituting the essence of a substance is much debated. On the 'subjective' interpretation they are different ways in which the mind conceives the same hidden essence, so that extension and thought are the same thing perceived differently. This interpretation is usually rejected now as anachronistically Kantian in making of the essence an unknown noumenon of which space and thought or mind are phenomenal versions. Certainly it would make Spinoza's position incoherent, for thought or mind would both be a misleading appearance of that common essence and the reality which misperceived it. At the other extreme is an 'objective' interpretation for which the essence of substance is simply the compound of all the different attributes. But this does not give Spinoza the principle, which he certainly needs, that one attribute in common implies all in common, and does not accord with his tendency to equate essence and attribute at times. This contributor's opinion is that each attribute is the essence grasped in a different way, but in a way which does justice to, rather than hides it. Just how the same essence can properly be grasped as either thought or extension (and perhaps in other ways by other minds) is, of course, problematic, but not necessarily impossibly so.

Spinoza does not deny all plurality. Distinct finite things certainly exist, but they are

modes of the one Substance, each of them intelligible (with enough knowledge) either as a physical or as a mental (or at least 'thought') unit. Human beings are thus psycho-physical 'modes' of the one psycho-physical substance.

Spinoza's view of the doings and sufferings of such modes is uncompromisingly deterministic. The necessary nature of the one Substance settles what the laws of nature are, and the doings of modes follow on each other according to these laws with strict necessity. Thus there are two sorts of necessity. (a) The essence of the one substance, and what immediately follows from it (the general unchanging structure and laws of nature), are necessary in an absolute way. (b) An event at the level of modes is necessary in the different sense that at every moment of infinite past time it was already settled that that event would occur, in virtue of conditions then holding plus the laws which follow from the one substance's essence. Without some additional premisses, doubtfully available to Spinoza, this does not quite make this world the only possible world, as Spinoza perhaps intended, but it does make every event necessary in a very reasonable sense of the word.

Spinoza sometimes seems a nominalist about universals. Certainly he holds that words for types of thing at the level of ordinary classification do not point to anything one and the same present in each instance, and that all such words therefore have what we would now call 'open texture'. But it seems that he thought that a deeper scientific understanding of the world would be by way of concepts which express certain basic pervasive structures of reality which figure as universals found in its every part or 'mode'.

The basic explanation of the behaviour of a mode, in particular a human being, is that it has a certain inbuilt *conatus* or tendency to persist in being with its individuating essence. What it does in any particular case is what is required if it is to have the best chance of survival. Interpreted in terms of the attribute of thought, a human's activity consists in his keeping those ideas going which present him to himself as surviving and prospering to the maximal extent the environment allows. But these ideas may either be confused, in which case he will both feel himself and be the victim of circumstances, or adequate, in which case he will both feel himself and be a doer who enjoys making the most of circumstances and understanding them well. The *conatus* explanation of behaviour is still by reference to the eternal nature of substance, with its implied laws of nature, since the *conatus* precisely is one particular specification of the pervasive structure of things which these impose. Spinoza's ethical views are an application of this basic claim to problems of human life and an attempt to make them active as adequate ideas in the reader.

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TIMOTHY L. S. SPRIGGE

States of Affairs

Within a speech act of asserting or a mental act of judging, a distinction can be drawn between two components: the particular act and its asserted or judged content. One cannot assert or judge without asserting or judging something. Besides the speech act indicating device or the psychological mode there necessarily is a representational content specifying what it is that is asserted or believed to be the case and so claimed or held to be true. In the cases of asserting and judging (and their variants) this content is always propositional, that is, it has the peculiar nature of a complex that represents both one or more things and a manner in which the intended things are conceived of. To take a simple example, in asserting or

judging that Socrates is a philosopher, one thinks of Socrates in particular and of philosophers in general and does so in the syncategorematic way of predicating one or the other. What is represented, then, is not things as such, but how things are: a state of affairs or a *Sachverhalt*. Moreover, such a state of affairs, communicated through a declarative sentence as meant and understood in a given situation and conceived of in the corresponding judgement, is something that can remain the same content of quite different particular acts of asserting and judging, either of the same person or of several persons.

Given that in asserting or judging one necessarily has before the mind a more or less specific state of affairs, the question arises of how the grammatical complement in such a phrase as 'thinking (of) a state of affairs' is to be interpreted. One way of taking it is as an internal accusative, like in 'dancing a dance' or 'signalling a signal'. On that view, the state of affairs concerned is not a kind of separate entity that is external to the act of conceiving and capable of existing even if there were no minds or language-users at all, but rather an internal structure and adverbial modification of the act as it is performed: one thinks-in-a-Socrates-is-a-philosopher-way, as one might dance a waltz or waltzily. Others – known as the logical realists – are of the opinion that especially the identity and the objective character of the states of affairs towards which various acts of judging and asserting can be directed is guaranteed only if it is assumed that a state of affairs has a peculiar kind of being of its own, independently of incidental acts of becoming aware of it. There are states of affairs whether or not they happen to be grasped by mental or linguistic devices; and when they are made the object of the appropriate ways of capturing them, what goes on is comparable, for instance, to the situation in which the same ball is caught by different people at different times.

Obviously, these two ways of interpreting the phrase 'thinking (of) a state of affairs' have very different ontological implications. In all probability such thinkers as Bernard Bolzano, Gottlob Frege, and Alexius Meinong were prompted to introduce abstract states of affairs – called *Sätze an sich*, *Gedanken*, and *Objektive* – which are independent of any mental or linguistic activities by the desire to free their logical properties and relations of the adventitious and irrelevant circumstances of particular acts of asserting and judging. It may be asked, however, whether the same result cannot be reached without positing a special category of entities whose status seems to many to be at best rather obscure. In conformity, for instance, with the approach defended by N. Rescher (1979), the mind-dependent nature of states of affairs might be rendered plausible by emphasizing that there are not only actually conceived and formulated states of affairs, but also merely conceivable ones, which, as potential products, derive their ontological credentials from the existence of minds and their functional capabilities and of language systems that in principle provide the means of constructing an infinite variety of possibilities, many of which will never be actually conceived or expressed. On that account, the ontological problem is reduced to more manageable questions about the kind of being that is typical of mental and linguistic operations and their actual or potential upshots and about the constraints that have to be put on them from the viewpoint of the logical roles they are to play.

Normally, the states of affairs that form the propositional content of acts of asserting and judging are claimed or held to be true. Whether they indeed are true depends upon the answer to the further question of whether or not the truth-conditions that are determined by the specific conceived state of affairs are satisfied. In other words, the claim that a certain conceived state of affairs or proposition has the property of being true can be justified only by producing evidence that the very same state of affairs is a fact. Now the word 'fact' has several shades of meaning, often in opposition to such words as 'fiction', 'theory', or 'value'. But even in the context that is relevant here, facts have been understood in widely different ways. Some philosophers, notably J. L. Austin (1961), simply identify them with such items in the world as phenomena, events, or situations. On the other hand, linguistic and other objections to

that position have led adversaries to contending that facts are nothing but true propositions. As that opposite view has its own implausibilities, it seems more promising to look for an elucidation that situates facts somewhere between those extremes. First of all, there is no compelling reason to suppose that the great variety of states of affairs that can be framed in thought and speech by applying the syncategorematic devices provided by the systems underlying them has in every case an exact one-to-one correlate in the world. On the contrary, it is arguable that the relationship between the propositional contents constructed and the world at which they are aimed is of a far more complicated nature. Roughly speaking, each type of propositional content includes its own set of truth-conditions and thereby points the way to the application of a more-or-less intricate complex of rules that determine how things are required to be and what the world is to be like in order that the truth-conditions can be deemed to be satisfied. If the world proves to be such that all the requirements inherent in the propositional content are met, the state of affairs in question is both a fact in so far as it is recoverable by the appropriate procedures in the actual world and true in so far as it is entertained by the mind and expressed in language. One might also say that then one and the same state of affairs has a twofold kind of being: as a representation that is a certain modification of acts of asserting and judging and as what the world is like when it is scrutinized along the lines indicated by the representation.

Among the advantages yielded by this view, three in particular stand out. To begin with, it accounts for the familiar datum that the same that-clause is used as the subject of both '. . . is true' and '. . . is a fact'. Further, it becomes comprehensible how one can speak of the states of affairs meant by, for instance, negative, existential, universal, conjunctive, disjunctive, and conditional sentences as facts without thereby committing oneself to an ontological doctrine according to which such facts are considered to be part of the furniture of the world in the same sense as, for example, particular things and events may be regarded as being given out there. Third, on this approach it is relatively easy to explain how there can be, besides revealed and known facts, also facts that have never been thought of or formulated and will perhaps never be brought to light. The conceptual capacities of the human mind and the descriptive machinery of language contain, in addition to actual products, an unlimited amount of potential propositional constructions, each with its own truth-conditions. These dormant representations of states of affairs are yet of such a nature that at least some of them fit the actual world: if they were conceived of, they would be found to be true. States of affairs, as they are both actually conceived of and merely conceivable within the possibilities made available by the resources of thought and language, may be likened to questions that are put to the world. The positive or negative answer is given by what the world is like when looked at according to the requirements laid down by the question.

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GABRIEL NUCHELMANS

Stoics. See: Chrysippus; Panaitios; Posidonius; Diodorus Cronus; Zeno of Citium.

Stout, G. F.

George Frederick Stout (1860–1944) began his academic career in 1884 in Cambridge, where he had studied classics and philosophy. He held posts at Aberdeen and Oxford and in 1903 became professor of logic and metaphysics at St. Andrews, a post which he held until his retirement in 1936. From 1891 until 1921 he was editor of *Mind*, which became during this period the most important British philosophy journal.

Stout's first book was his *Analytic Psychology* (1896). Stout had been taught by James Ward (1843–1925) and here reiterated Ward's criticisms of the associationist tradition that had long been dominant in Britain. In its place, Stout introduced Franz Brentano's thesis that all mental states involve reference to an object. Indeed Stout's book was the primary vehicle for the importation into British psychology and philosophy of Brentano's ideas, which he extended by developing a version of the familiar act/content/object conception of mental states.

Stout's next, and most successful, book was his *Manual of Psychology* (1899, 5th ed. 1938). He here stressed the reality of the '*sensa*' we experience in perception, but rejected Lockean representative theories of perception. His view was that these *sensa* are the contents of perceptual acts and essentially include reference to an object. In developing his account of this reference to an object in perception, Stout stressed the role of the will: his thought was that in bodily activity we encounter the resistance of things, thereby forming the idea of an external world, which is then enriched through attention to perceptual experiences. Stout cites with approval the view of Spinoza that "ideas are not dumb pictures on a tablet, but specific modes of the primary *conatus* which constitutes our being". Again following Spinoza, Stout rejected both Cartesian dualism and materialism. In their place he proposed a conception of the mind as the embodied self, and held that we encounter our bodies in two different ways, objectively, as material objects like other material objects and subjectively, as our means of perception and action. Stout never worked this idea out in any detail, but it has similarities with the position later advanced by Maurice Merleau-Ponty. The outcome of all this is an eclectic philosophical psychology, similar in some respects to the positions advanced by the Austro-German school and the phenomenologists, but informed throughout by a dose of Scottish commonsensism and a thorough knowledge of empirical psychology.

In addition to his psychological works, Stout published many papers on straightforward philosophical topics. His most famous concerns particulars and universals. He here advances the view that universals should be regarded as classes of "abstract particulars", the qualities of particular things which form the basic ontological category, persisting substances being themselves spatio-temporal composites of these particulars. Stout's position was famously criticized by G. E. Moore, but has recently come back into favour.

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THOMAS R. BALDWIN

Strawson, P. F.

Peter Strawson was born in 1919. He received his BA from Oxford in 1940, served in the wartime military forces for six years, and returned to Oxford in 1947 to begin a distinguished career. His importance lies in his

continuing concern with the relations between the systems of formal logic and the logical features of ordinary language, and his consequent interest in perennial metaphysical questions.

Paradigmatic of his concerns within the philosophy of language is his criticism ("On referring", 1950, and *Introduction to Logical Theory*, 1952) of Bertrand Russell's theory of definite descriptions. For Russell, every sentence is true, false, or meaningless. Consider 'The king of France is wise'. For Russell, that sentence is false, and therefore meaningful, if there is no king of France:

'$\neg(\exists x)(fx)$' entails
'$\neg(\exists x)[fx \ \& \ (y)(fy \supset x=y) \ \& \ gx]$'.

Strawson's counter-proposal distinguishes sentences from statements made using sentences. 'The king of France is wise' is a meaningful sentence just because there are possible circumstances in which its use would result in a true or false statement. Its present use as a statement is neither true nor false, since its presupposition that there is a present king of French is false. Strawson thus clearly wishes to distinguish presupposition from entailment.

Individuals (1959) is concerned with the identification and reidentification of particulars. Strawson argues that enduring material bodies located in a public spatio-temporal frame are the basic particulars which make possible our identifying references to particulars of all other classes. He also argues for the primitiveness of the concept of a person: states of consciousness are ascribed to the very same thing as are corporeal characteristics. Strawson supports this 'descriptive metaphysics' linguistically by asserting a persistent link between the particular–universal distinction and the subject–predicate (reference–predication) distinction. Thus the subject expression 'John' presupposes some empirical fact identifying a particular, and is to that extent complete. In contrast, even such a 'universal-cum-particular' predicate expression as 'is married to John,' taken *as a whole*, has no such presupposition of *its* own, and is incomplete. Strawson finds here an additional depth in Gottlob Frege's metaphor of the saturated and unsaturated constituents of a sentence.

In *The Bounds of Sense* (1966), Strawson seeks to disentangle within Kant's *First Critique* the general doctrine of metaphysical idealism from Kant's specific arguments in the Analytic and Dialectic. The Analytic cogently holds that there is an explicable conceptual framework which provides the essential and limiting features presupposed by all our empirical enquiries. The Dialectic then provides a demolition of the illusions built upon those ideas for which no empirical conditions can be supplied. For Strawson, these arguments survive their separation from Kantian idealism. Strawson finds this idealism inconsistent because he thinks that it claims both that the general features of our experience have their sole source in our cognitive constitution and that we are affected by an unknowable noumenon.

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CLIFFORD BROWN

Structuralism

The Hylomorphist Problem of Whole and Parts. Structuralism is the name given to a specific treatment of a traditional problem, that of the relations of dependence between a whole and its parts.

Generally, the structure of a whole presupposes that the whole is *organized*, and that the parts are 'organically' connected by *relations*. The theoretical problem arises when the organized whole is not reducible to the interactions of its components, i.e. when a 'systemic' organization and regulation exist making the whole more than the sum of the parts. The problem then becomes that of the ontological status and of the type of *objectivity* of the phenomena in question – called 'structures'.

It is impossible to think theoretically about the concept of structure without a conceptual

framework which in one way or another appeals to a neo-Aristotelian hylomorphic ontology. If a structure is no longer causally reducible to the physical interactions of its material constituents, it becomes identified with something like a *relational form* of the organization of a *substrate*. As a relational form, it is therefore an ideality and the whole difficulty lies in understanding how it can *emerge* from the substrate where it is materially realized. In treating it theoretically, therefore, one inevitably runs into the philosophical alternative between realism and nominalism. The nominalist will see structural connections in terms of mere relations of meanings (possibly realized psychologically). The realist will counter with *relational substantial accidents* in the things themselves. In modern times it is the nominalist viewpoint that has largely prevailed.

The Genealogy of Structuralism. There is a philosophical *genealogy* of structuralism which can be very briefly summarized as follows:

1. In Leibniz, there are still two competing ontologies, one which is Aristotelian (monadological), and another which is physicalist (mechanistic). The former, we might say, reflects an attempt to come to terms with the dynamics of interiority. The latter, in contrast, flows from a more objective standpoint in relation to what is exterior. It represents a mechanistic-atomistic point of view according to which bodies are mere aggregates and secondary qualities are mere subjective-relative appearances. If, then, one wants to capture structural and qualitative phenomena other than as simple psychological projections, then one must, Leibniz affirms, move beyond the atomistic standpoint and again appeal to the Aristotelian concepts of *substantial form* and *entelechy*. Leibnizian substantial forms are internal dynamic principles of individuation, stability, and organization. Their function is to account for the way in which a material substrate can become the 'subject' of *perceptible* and *predictable* accidents and qualities.

2. With Kant, the category of *substance* is reinterpreted in a way that shatters the Leibnizian ontological duality and banishes definitively the neo-Aristotelian element. As Kant explains in his *Critique of Judgement*, biological organization (which he calls the 'objective internal finality' of organized beings) is not available to mechanistic objectivity, which is the only genuine objectivity. Although empirically real, biological organization is not truly objective. It cannot be captured by any *determinant* concepts but only by the noumenal 'idea' of totality. But for transcendental reasons, it is impossible for any noumenal idea to be unfolded spatio-temporally, which is to say phenomenally. This is why the morphological organization of the sensible world remains an "unfathomable abyss" and a "mystery of reason", as Kant expressed it.

3. After Kant, *Naturphilosophie* and *vitalism* would each infringe upon this verdict and attempt, after the fashion of Leibniz, to rehabilitate a certain type of Aristotelianism. This is especially in the case of the Goethe of the *Metamorphosis of Plants*, who sought for half a century to understand how an '*a priori* principle of entelechy' – an internal organizing dynamic principle – could unfold itself spatio-temporally and, in so unfolding, generate morphologies. For Goethe (1749–1832), inspired here by the speculative idealism of F. W. J. Schelling (1775–1854), entelechy is an *intuitive concept* in which an intelligible entity becomes concrete and perceptible (all of which is a heresy for Kant). It is with Goethe that there first appears a *dynamical structuralism* of the sort that is carried on both by semioticians like Charles S. Peirce and by vitalist embryologists like Hans Driesch (1867–1941), d'Arcy Wentworth Thompson, and Hans Spemann, and culminating in the work of C. H. Waddington and René Thom in our own day.

The importance of this tradition for structuralism is not to be underestimated. Thus, in his last work, Claude Levi-Strauss confessed that it was 'neither to logicians nor to linguists' that he owed the central structural concept of *transformation*, but rather to d'Arcy Thompson.

> It was an illumination, so much so that I would fast realize that this way of looking at things was part of a long tradition: behind Thompson there was Goethe's botany, and behind Goethe, Albrecht

Dürer with his *Treatise on the Proportion of the Human Body* (Levi-Strauss, *De Près et de Loin*, Paris, 1988).

4. This said, it must be remarked that *Naturphilosophie* and vitalism have, like Aristotelianism, been robbed in turn of their scientific status. Their proscription led to a resumption of work on the problem of the relations between wholes and parts on a different basis. After Franz Brentano developed the principal Aristotelian themes once again in his psychology, *Gestalt theory* became responsible for one of the main revivals of the problem. Unlike sensationalistic atomism and associationism, Gestalt theory gives priority to perceptual organization. In Gestalt theory perceptions are not reducible to relations among atomic sensations. They are dynamic, organic, holistic, and individuated 'complexes' possessing 'qualities' and 'moments' that cannot be explained by reductionist techniques.

5. The other essential revival was, of course, that of phenomenology. Here the question of structures is connected to a new doctrine of *objectivity*, i.e. to the objectivity of the logical structures of formal ontology (cf. the analysis of whole/part relations in Edmund Husserl's third *Logical Investigation* and in the collection *Parts and Moments*, Munich, 1982).

What, then, is the nature of the objectivity of structures? Here we can distinguish four principal options: vitalist naturalism, semiotics *à la* Peirce, Gestalt psychology, and a formalist psychology, i.e. a representationalist and symbolic mentalism of Fodorian type according to which there exists an internal formal language, a 'language of thought' or 'mentalese'. In certain thinkers such as Maurice Merleau-Ponty there is even an attempt to synthesize these four alternative objectives (cf. for example *Sens et Non-sens*, Paris, 1948). Merleau-Ponty's structuralism starts out from a phenomenology of perception and ends up in a progressive reconstitution of the old idea of *Naturphilosophie*.

Contemporary Structuralism. Structuralism itself consists in the theoretical reflection on *symbolic and semiotic* structures in general and on *language* in particular. After the revolutionary work of Ferdinand de Saussure (1857–1913), the work of the Prague Circle on *phonology* played a particularly important role in establishing the bases of the new view. When studying a phonological system, a distinction must be made between the phonetic 'matter' of the sounds of the language (audio-acoustic in nature) and the phonological 'value' (which is properly linguistic). Sounds can vary continually. But they group together in *equivalence classes* – in categories – and it is this discriminating categorization with regard to the audio-acoustic continuum which defines the *phonemes*. Without this categorization, the phonetic *flux* could not serve as a substrate for the phonological *code*. So a distinction between the phonetic *substance* and the phonological *form* clearly appears. This phonological form is abstract. It makes it possible for us to discriminate between sound differences which are phonologically (i.e. linguistically) pertinent (for example, the contrast in voicing between the occlusives [b]/[p] is pertinent in English [gib] ≠ [gip], but when in the final position it is not pertinent in German [gib] = [gip]). This is what is called a system of discriminant differences, or of distinctive features. The phonological form is 'realized', like an Aristotelian μορφή, in the sound substance. Structuralist theories accord it ontological autonomy. Those of Roman Jakobson (1896–1982) and Louis Hjelmslev (1898–1965) can be cited here (cf. J. Petitot, *Les Catastrophes de la Parole*, Paris, 1985).

The structuralist approach has proved fundamental also in the area of syntax. Linguistic sentences characteristically involve constituents co-ordinated by certain syntactic relations. But the latter enjoy certain semantic roles or grammatical relations which must be accounted for as ideal relational structures giving form to the underlying substance.

Following considerable progress made in the various areas of linguistics through the use of structuralist methods and concepts, structuralism has developed extensively in the social sciences, in particular in anthropology with the work of Levi-Strauss, and in semiotics with the work of Louis Hjelmslev, Vigo Brøndal, and Algirdas Julien Greimas.

Morphodynamical Structuralism and the 'Physics' of Meaning. However successful this classical structuralism may have been, the problem of the mathematization of structures has been left wide open. This problem began to be genuinely tackled only after René Thom succeeded in developing dynamical models of morphological structures and morphogenetic processes. This is understandable since, as we saw, structuralism is genealogically grounded in Aristotelian hylomorphism and the morphodynamical structuralism developed by René Thom and his collaborators furnished the first mathematical models of structures able to do justice to the fact that the contents of the latter are, contrary to what is usually believed, topological and dynamical – not logical and combinatorial. They are impossible to mathematicize without recourse to a *position geometry*. Any *value* in the structuralist sense of the term is a *positional value* in a certain space. What is more, Thom's morphodynamical schematism shows that this topological and dynamical content is compatible with the mathematical theories of physics. This provides a way of overcoming the traditional opposition between matter and form by identifying the relational form of structures with the organizational morphology of their substrates.

Thus for the first time in the modern era a mathematical theory of the concept of substance can be developed which gives a way of unifying naturalist-vitalist and phenomenological-formalist points of view within the framework of a neo-Aristotelianism that is compatible with physical objectivity. Such is, undoubtedly, the deep metaphysical meaning of the scientific revolution brought about by modern theories of organization. Within this new theory of substance, a *physics* and a *semiotics* of organization combine. This is why dynamical structuralism opens the way to a 'Semiophysics' or 'Physics of Meaning'.

See also: **Mathematical Structures; Metaphysics VI.**

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JEAN PETITOT

Stumpf, Carl

Carl Stumpf (1848–1936), Franz Brentano's first distinguished student, and the inspirer of the Berlin School of Gestalt Psychology, studied in Würzburg with Brentano and in Göttingen with Rudolf Hermann Lotze under whose direction he obtained his habilitation in 1870. An early interest in the concept of substance provided material for his first book on the psychological origin of our representation of space (1873). This led to a chair at Würzburg in the same year. In this early work Stumpf criticized Kant's claim that colour is one-sidedly dependent on perceived extension, and argued for a two-sided dependence relation, a special case, he held, of the "metaphysical relation" which holds between the accidents of a substance.

Stumpf's interest in music and in the foundations of psychology led to his major work on the psychology of sound (*Tonpsychologie*, Leipzig, 1883–90). Stumpf said later of the *Tonpsychologie* that it "should not be considered as a phenomenology of sounds but as a description of the physical functions provoked by sounds". The main problem dealt with in the book is our recognition of auditory patterns and their elements. Stumpf introduces the notion of sensory judgement, meant to cover the cases

of measurement of tonal distance, and of comparison of auditory sensory contents, and soon describes certain regularities in our judgements about simultaneous or successive presentations of sounds, in which a major role is played by the phenomenon of *Verschmelzung*, the relative fusion shown by simultaneous sounds. This concept is used to explain the phenomenon of consonance: the more a chord is heard as fused, the more it is judged as consonant, and the octaves are the most consonant intervals in virtue of their high degree of fusion.

Stumpf's appeal to *Verschmelzung* in the *Tonpsychologie* oscillates between psychophysical and phenomenological considerations; the latter in particular are still a valuable source of inspiration for philosophers interested in sound. Stumpf insisted on the importance of experimental work, which he pursued in Würzburg and later in Prague (1879–84) where his colleagues included Anton Marty, Ewald Hering (1834–1918), and Ernst Mach. A long friendship with William James also began during this period.

In his lectures at Halle (1884–9) he used for the first time in 1888 the term *Sachverhalt* to designate the content or correlate of an act of judgement. It was in Halle also that he met Edmund Husserl, who was first his student and then his colleague. From Munich (1889) Stumpf moved to Berlin (1894) where he received a substantial grant in order to develop the psychological institute, where a number of psychologists such as Max Meyer, Erich M. von Hornbostel, Gustav Johannes von Allesch, Felix Krueger, and later Wolfgang Köhler, Kurt Koffka, and Max Wertheimer worked. Stumpf's subsequent work is divided between descriptive psychology, experimental research largely in the area of acoustics, and a series of contributions to general philosophy.

Stumpf distinguished his concept of phenomenology from that of Husserl, whose theory of intuition of essences he never accepted. His methodological orientations ("Zur Einteilung der Wissenschaften", *Abhandlungen der königlichen preussischen Akademie der Wissenschaften*, 5, 1907, pp. 1–97) are based on a three-way distinction between human sciences, natural sciences, and proto-sciences (*Vorwissenschaften*). Human and natural sciences deal, respectively, with phychical functions and physical objects. So, for instance, neurophysiology is a natural science, psychology is a human science in so far as it deals with psychical functions of low complexity, phenomenology, as well as eidology (the science of values, concepts, *Sachverhalte*) and the theory of relations, are proto-sciences. The latter are 'neutral' in the sense that they can relate to objects taken from all spheres.

Stumpf developed an interdisciplinary way of doing descriptive psychology, paying continuous attention to empirical results. In his "Über Gefühlsempfindungen", *Zeitschrift für Psychologie*, 44, 1907, pp. 1–49, he defends a distinction between emotions and emotional sensations (*Gefühlsempfindungen*, sensations of feeling). An emotion is based upon a judgement and is directed to some state of affairs; sensations of feeling are a particular class of sensations, not reducible to simple sensations. In his "Erscheinungen und psychische Funktionen" (*Abhandlungen der königlichen preussischen Akademie der Wissenschaften*, 4, pp. 1–40) he stresses the relative independence of appearances (*Erscheinungen*) and psychical functions. The former are the contents of sensory perception or memory; the latter are *acts*, for example of judgement, desire, noticing. Appearance and function can vary independently of each other. *Gestalten*, aggregates, values, and *Sachverhalte* are neither appearances nor functions, but the contents of functions.

Stumpf repeatedly criticizes the neglect of psychological evidence in the Kantian epistemological tradition, denouncing its main thesis that there is a unification of dispersed contents (he refers to such putative unification as "*psychische Chemie*") and expressing the principle that "something cannot be epistemologically true and psychologically false" ("Psychologie und Erkenntnistheorie", *Abhandlungen der bayerischen Akademie der Wissenschaften*, 19, 1892, p. 482).

In his posthumously published masterpiece *Erkenntnislehre* (*Theory of Cognition*, 1939–

40), he seeks to explain the source of our formal concepts such as 'being' or 'necessity'. Here he develops a broadly Brentanian intuition, that these concepts "do not originate from internal perception in the old Lockean sense, but from presentations of determinate properties of [psychological] structures". The wide range of aggregations and combinations of appearances gives Stumpf enough material to develop a structural account of the possible meanings of formal concepts, which are mirrored in the psychological structures.

In the second part (on immediate knowledge) he criticizes, again, Husserl's conception of phenomenology, accepting regional phenomenologies but denying the possibility of a pure phenomenology. He then refines conceptually the notion of Gestalt, classifying Gestalten as strong/weak, divisible/indivisible, persistent/non-persistent, simultaneous/successive, and developing a detailed account of temporal Gestalten. Stumpf objects to the conception of the Berlin School, according to which Gestalten are primary, both ontologically and phenomenologically, with respect to their parts and to single sensations. He holds, on the contrary, that even when a single content appears to change in different configurations, the change just affects the functional role of the content and not the content itself.

By continuously appealing to immediate experience, Stumpf was forced to revise some of the main concepts of the empiricist tradition, to which he belongs. A substance cannot be considered as a bundle but is rather a unity of qualities. Moreover, we can directly perceive causation, both in our acts and in the perceived world. His philosophy, as well as his psychological investigations, is thus an important contribution to our general understanding of structured wholes.

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ROBERTO CASATI

Suárez, Francisco

Francisco Suárez, Spanish philosopher and theologian, known as 'Doctor Eximius', was born in Granada on 5 January 1548, at a time when Spain was at the height of its imperial power. At an early age, he chose an ecclesiastical career and went to Salamanca to study canon law. There he requested admission into the Society of Jesus. At first his application was refused, since neither his health nor his intellect were considered strong enough to withstand the pressures of the order. After repeated insistence, he was allowed to join the society in the year 1564. Between 1566 and 1570 Suárez studied theology, and at the end of that period he began a teaching career that took him to several of the most famous academic institutions of his time, located in Segovia, Valladolid, Rome, Alcalá, Salamanca, and finally Coimbra, where he was appointed to the chair of theology by Philip II in 1597 and where he taught until 1615. He died in Lisbon on 25 September 1617.

Suárez's published works fill twenty-eight large volumes. His first work, *De incarnatione verbi*, appeared in 1590 and a steady stream of publications in the areas of metaphysics, theology, and law followed. His most important metaphysical treatise, the *Disputationes Metaphysicae*, first published in 1597, earned Suárez his reputation as the greatest of scholastic authors after Thomas Aquinas, and underwent twenty editions within a few years of its publication. Indeed, many modern philosophers, from René Descartes to Arthur Schopenhauer (1788–1860), and including such important figures as Leibniz, Spinoza, Christian Wolff, George

Berkeley, and Giovanni Vico (1668–1744), learned metaphysics from them. It was only in the 19th century, with the decrease of logical rigour in philosophy made fashionable by the German romantics and the rise of Thomism among Catholic theologians and philosophers, that the influence of Suárez's *Disputations* waned.

The philosophical and historical importance of the *Disputations* derives in part from the fact that it is the first systematic and comprehensive treatise on metaphysics produced in the West that is not a commentary on Aristotle's *Metaphysics*, and also that it contains and summarizes the metaphysical thought of 1500 years of Patristic, medieval, and scholastic speculation. The fifty-four disputations cover practically every metaphysical topic, from the nature of metaphysics to the ontological status of mental entities.

There are several areas where Suárez is thought to have made major contributions to metaphysics: the nature of metaphysics and the concept of being, individuals, universals, relations, the distinction between essence and existence, prime matter, modes, proofs for God's existence, and privations and non-beings. Here I shall comment on only the first four of these ideas.

Metaphysics and the Concept of Being. Suárez defines metaphysics as "the science that considers being in so far as it is real being" (*ens in quantum ens reale*) (*Met. Disp.* II, s.1, 26 and s.3, 1). He rejects the views of metaphysics that include purely accidental and conceptual being in its object and argues against those views that restrict its object to God, immaterial substances, and/or substantial entities. The being that is the object of metaphysics cannot be purely accidental, unreal, or restricted to only certain types of beings. Many scholastics had expressed views similar to this prior to Suárez, but they debated whether there is a univocal concept of being that would support such an understanding of metaphysics or whether there is no single and overall concept of being. Suárez opposes both univocal and equivocal concepts of being, favouring a doctrine based on the notion of analogy. According to him, there is a single objective concept of being through which the mind understands being and which prescinds from every particular notion of being. But for this to be the case, it is not required that such an objective concept itself be a thing or that there be a real thing in the world that exactly corresponds to it. The only requisite is that the concept be analogically derived from the similarity among things from which the mind derives it (II, s.2, 16).

Individuals. Everything that exists, including substances as well as their properties, accidents, principles, and components, is individual (V, s.1, 4). Hence the unity proper to individuals has universal extension. Individuality is defined as the incommunicability of those things that cannot be divided into entities of the same specific kind as themselves. By 'incommunicability' Suárez means the inability to be, or to be made, common. While a universal such as man is communicable in so far as it can be divided into men, an individual such as Peter is incommunicable because he cannot be divided into men (V, s.1, 2). Apart from being incommunicable in the stated sense, individuals are also numerically distinct from all other entities, but this is a consequence of their individuality and not part of what it means to be an individual (IV, s.3, 12).

The principle of individuality in things is their 'entity', which Suárez identifies with "the essence as it exists". Thus, for example, the principle of individuation of Socrates is Socrates' entity. And Socrates' entity is no other than Socrates' essence, namely 'man', as it exists, that is as the man Socrates is. This interpretation of the principle of individuation applies not only to substances, but also to their accidents and components. In simple entities the principle of individuation is itself simple, but in composite ones it is composite. In composites of matter and form, for example, it is the matter and the form united as an entity that individuate the substance, but in non-material substances it is simply the non-material essences as they exist (V, s.6).

Suárez's originality in this area is clear, first, from his explicit distinction between communicability (that is, the ability to be or to be made common) on the one hand and distinction on the other, and, second, from

his conception of individuality primarily in terms of the former. It is also evident in his rejection of the standard views on the principle of individuation available at the time: the Thomistic view of designated matter and the Scotistic notion of thisness (*haecceitas*) as principles of individuation, and the Ockhamist view that individuals are essentially individual and therefore need no principle of individuation.

Universals. Universality is, like individuality, a kind of unity, but it is the unity of communicability rather than of incommunicability (VI, s.2, 9). That is to say, universality is the unity proper to those things that are or can be made common, such as man, dog, and tree. Since only individuals exist, universals have no ontological status either outside individuals or in individuals. Universals are mind-dependent and result from the operation of the mind that abstracts a common likeness among things. Because they result from abstraction, universals have a foundation in reality, namely the individual form. The latter is potentially universal in so far as it can be the cause of the universal in the mind. But this potentiality cannot be construed as a reality or unity in individuals. Individuals do contain a formal unity, but that unity is the unity proper to the individual form and therefore incommunicable (VI, s.1, 12).

Suárez rejects, then, the position of John Duns Scotus, for whom the common nature is given a unity and a being in things that is formally distinct from the unity and being proper to the individual. He accepts the Ockhamist position that the universal has only a mental unity and being, but, contrary to William Ockham, he maintains that the individual form has a causal relation to the mental concept. Finally, approaching Aquinas's view, Suárez seems to hold that the nature considered in itself (that is, the nature considered apart from its relation to individuals or universals) is neither communicable, that is universal, nor incommunicable, that is individual (VI, s.5, 3).

Relations. Relations can be real or conceptual. Conceptual relations, like other conceptual beings, are constructs of the mind and therefore have no entitative status apart from the status proper to concepts: they are mental, not real beings. But the case is different with real relations, for they both exist and constitute a separate category of being, although they are not really distinct from their foundation. Suárez rejects Peter Aureoli's view that there are no real relations and Domingo de Soto's position that there are real relations but that they do not constitute a separate category of being (XLVII, s.1, 8). Following Aquinas, he accepts both the reality and distinct nature of relations. But, contrary to Aquinas and such Thomists as Cajetan (Thomas de Vio) and Francis Sylvester Ferrara (*c.* 1474–1528), he rejects the view that relations are really distinguished from the substances and accidents which they relate (XLVII, s.2, 2). He also opposes John Duns Scotus, who saw relations as having a peculiar kind of reality (XLVII, s.2, 7). In this respect, Suárez's view is similar to that of the nominalists Ockham and Gregory of Rimini (*c.* 1300–58), for whom relations are distinguished only conceptually from the *relata*: relations are extensionally identical with their foundation but conceptually distinct from the *relata* (XLVII, s.2, 2). What this means may be better understood through an example. Take the relation of father to son between Philip and Alexander. According to Suárez, the foundations of the relation are Philip, who is Alexander's father, and Alexander, who is Philip's son. Moreover, there is no extensional distinction between the relation of Philip to Alexander and Philip and Alexander, for there is no third thing or reality other than Philip and Alexander. However, conceptually, to be Philip is not the same as being Alexander's father, just as to be Alexander is not the same as being Philip's son.

Much of the controversy concerning the interpretation of Suárez's thought among scholars has centred around the question of whether he can be classified as a nominalist or a realist. It should be clear that Suárez's ontological views do not fall easily into either camp. In most cases his views differ in important respects from those of other major scholastics, even though he freely borrows from them whenever he deems it appropriate. His thought cannot, therefore, be

regarded as Thomistic, Scotistic, or Ockhamist; it is simply Suarezian.

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JORGE J. E. GRACIA

Substance

Aristotle. As heirs of the classical empiricist tradition, 20th-century analytic philosophers find it reasonable to ask whether substances exist. For Aristotle, in contrast, whose discussions introduced the concept into the Western philosophical tradition, the existence of substances is a kind of truism. The term from his writings that is typically rendered 'substance' is 'οὐσία'. A better translation might be 'reality' since, as he used the term, to identify the οὐσίαι is to identify that smallest set of objects such that we can truly say of its members, 'If none of these things existed, nothing else would either'. Substances are those independent existents on which everything else depends for its existence. Accordingly, the notion of a substance is a functional notion, the concept of something that plays a certain explanatory role in the kind of account the ontologist provides; and the claim that there are no substances is the suggestion that reality lacks a coherent intelligible structure, a suggestion Aristotle would not take seriously.

But if the existence of substances does not represent a genuine philosophical issue for Aristotle, the attempt to identify the things playing the explanatory role associated with the concept and to justify the relevant identification does. And it turns out that Aristotle's own thinking on this issue undergoes important changes throughout the course of his career. In early writings like the *Categories*, the notion of a basic subject of predication figures prominently in his attempt to identify the οὐσίαι or genuine realities. He tells us that the primary substances are the things of which other things are predicated but which are not themselves predicated of anything else. But although the notion of an ultimate subject of predication lies at the core of Aristotle's earliest account of primary substance, he resists the idea that these subjects are unpropertied bearers of properties. He identifies basic subjects with the familiar particulars of common sense, telling us that they are things like "a certain man and a certain horse" (*Cat.* 2a 13); and he takes the appeal to sortals here to be critical in picking out just what it is about primary substances that gives them their reality. His primary substances fall under species; and these species function as what he later calls essences for their members. They mark out primary substances as what they are and provide object-concepts for basic subjects. Accordingly, Aristotle calls the kinds under which primary substances fall secondary substances.

In later writings like the *Physics*, Aristotle confronts the fact that the primary substances of the *Categories* have temporally bounded careers, that they are things that come to be and pass away. To accommodate this fact, he construes ordinary objects as composites of matter and form; but he interprets the relationship between the matter and form constituting a familiar particular as that of predication. He tells us that the form is predic-

ated of its matter; and in the *Metaphysics* this account leads Aristotle to question the idea that the primary realities are basic subjects of predication. In the light of the hylomorphic analysis, this idea entails that matter is primary substance; and as Aristotle sees it, matter lacks the determinateness required of what is to play the explanatory role of a primary reality. Although the Aristotle of the *Metaphysics* does not want to deny that the familiar particulars of the *Categories* are genuinely real, the insight that they are composites of prior entities entails that they cannot be the primary substances. As he sees things, the only plausible candidates for status as primary οὐσία are the substantial forms in virtue of which ordinary particulars are the kinds of things they are; and so we have the central claim of the middle books of the *Metaphysics* that form, construed as the paradigmatic instance of an essence, is primary substance.

Empiricism. Now the idea that the concept of substance is a functional notion of something that plays the relevant explanatory role does not enter into classical empiricist discussions of substance. The controlling idea in these discussions is that substance is the subject for or thing 'standing under' the various attributes we associate with an ordinary object; nor is the essentialist thrust of Aristotle's characterization of basic subjects a feature of the empiricist notion of an underlying subject or possessor of attributes. The empiricists assume that the literal possessor or bearer of an attribute is something which has a being distinct from that attribute and which can be apprehended independently of it. Accordingly, the idea of substance becomes the idea of a constituent of an ordinary object which in itself lacks all of the attributes we associate with that object, but which serves as the literal bearer or possessor of those attributes; and the existence of substance becomes a question about which there can be philosophical debate. John Locke apparently concluded that since the attributes associated with a familiar object require a subject or possessor, there are such constituents; but since the subjects in question lack any attributes in virtue of which they could be conceptualized, he was uneasy with this conclusion. Locke's uneasiness here leads to George Berkeley's outright denial that in the case of the ordinary objects making up the physical world there are any such underlying subjects of attributes. Ordinary objects, he insisted, are mere bundles of qualities; but Berkeley was unwilling to reject completely the Lockean idea that attributes require a subject. He provides a phenomenalist treatment of external objects and goes on to insist that the ideas making up our mental lives have to inhere in a spiritual substance. David Hume, in turn, found the notion of an unpropertied possessor of properties equally unacceptable in the case of the material and the mental and extended Berkeley's bundle theoretic treatment of ordinary objects to the case of the human mind.

Analytic Metaphysics. Twentieth-century analytic thinking on these issues has been heavily influenced by classical empiricist discussions, and the opposition between bundle theoretic analyses and those that endorse the idea of an underlying subject or substratum of attributes has been pivotal in recent ontology. Some philosophers (like A. J. Ayer (1910–88) and the later Bertrand Russell in his *Human Knowledge: Its Scope and Limits*, 1948) have agreed with Hume that the notion of an unpropertied possessor of properties is inconsistent with the rigours of a thoroughgoing empiricism and have followed him in taking both material objects and persons to be mere constructions of attributes or properties that enter into a contingent relation of 'togetherness' or co-presence. Since they take the properties associated with an ordinary object to exhaust its ontological constituents and since they typically endorse the following principle:

> Necessarily, for any object, *a*, and any object, *b*, if, for any object, *c*, *c* is a constituent of *a* if and only if *c* is a constituent of *b*, then *a* is identical with *b*.

proponents of a bundle theoretic account are committed to the truth of the following principle:

> Necessarily, for any object, *a*, and any object, *b*, if, for any property, *P*, *P* is an attribute of *a* if and only if *P* is an attribute of *b*, then *a* is identical with *b*.

This principle (one version of what has been called the Identity of Indiscernibles) presents no problem for those bundle theorists who provide a nominalistic analysis of properties and deny that it is possible for numerically distinct objects to possess one and the same property. But unlike the classical empiricists, contemporary bundle theorists have typically been metaphysical realists or Platonists about properties and have insisted that a single property can be multiply exemplified. On their view, exactly similar or qualitatively indiscernible objects would be composed of precisely the same constituents and so would be numerically one object. But while critics of the bundle theory concede that, as a matter of contingent fact, no two objects may share all of their properties, they follow Kant in insisting that the existence of qualitatively indiscernible objects is a metaphysical possibility and so conclude that the bundle theory is false. They deny that the bundle theorist can appeal to the properties determining an object's unique spatio-temporal location in the attempt to show the truth of the Identity of Indiscernibles; for while they may agree that it is a necessary truth that each object has its own peculiar spatio-temporal history, critics deny that the spatio-temporal features of ordinary objects can be among the materials the bundle theorist appeals to in the analysis of those objects. Space and time are relational, they argue; accordingly, the relevant spatio-temporal properties presuppose rather than underlie the individuation of ordinary particulars.

Some philosophers (like Gustav Bergmann and the early Russell), who find the falsification of the Identity of Indiscernibles grounds for rejecting the bundle theoretic account of ordinary objects, have argued that the possibility of numerically distinct, but qualitatively indiscernible objects shows that each ordinary object incorporates a constituent over and above the properties we associate with it. Bergmann calls these individuating constituents "bare particulars"; and although he introduces them as the constituents that underwrite numerical difference, he goes on to characterize them as the literal possessors or subjects of the various properties with which they are co-present. So bare particulars are the underlying substrata that were so controversial in the classical empiricist tradition. Defenders of bare particulars are, however, anxious to deny that their bare particulars are Aristotelian substances. They are more sensitive than Locke, Berkeley, and Hume to the complexities of Aristotle's thinking on these issues. They recognize as central in an Aristotelian substance ontology both the essentialism they reject in construing their individuators as bare and the anti-reductionism implicit in the view that things like 'a certain man and a certain horse' are full-fledged realities. On their view, the objects for which Aristotle reserved the title "primary *ousia*" in the *Categories* are mere constructions out of more basic ontological materials. As Bergmann puts it, familiar objects are facts, not things.

The contemporary debate has, of course, included substance-ontologists, philosophers (like P. F. Strawson) who defend the *Categories* view that ordinary natural objects (non-artefacts) are (1) ontologically irreducible or primitive and (2) ontologically prior to entities of other metaphysical categories. Typically these substance ontologists have defended some version of essentialism, maintaining that among the attributes associated with an ordinary object, some (but not all) are exemplified essentially or necessarily. They insist that the attributes essential to ordinary entities constitute those entities as candidates for substancehood and provide object-concepts for them. Some follow Aristotle in insisting that the relevant essential properties are general features like the kinds or sortals that were so prominent in the *Categories*. Others, however, have wanted to supplement reference to general or shared essential attributes with the appeal to individual essences or what have been called *haecceities*. On this Leibnizian view, each substance exemplifies essentially a property that is necessarily unique to it and functions as an individual concept for that substance.

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MICHAEL J. LOUX

Substrate

The notion of substrate (ὑποκείμενον) developed in Aristotle's *Physics* and made use of in scholastic systems is one of the subtlest in the whole of philosophy. The Ionians had sought to identify an actual element as the underlying and hence unifying principle of things. Aristotle, in contrast, discovered a substrate of material substance in the course of his analysis of change (*Phys.*, Book 1). Such 'prime matter', as he called it, is not claimed to be a substance or underlying 'stuff', but a principle (αρχή) of substance, i.e. that from which substance *proceeds*, as it equally proceeds from matter's correlate, form, this being the other principle of substance. Matter corresponds to potentiality and so is not *actually* anything. It is, rather, the *perishability* of individual things, i.e. their potentiality to become other things, for it is the cause, not the result, of their having quantity or 'parts outside parts' (as quantity is defined), making them composites which can 'fall apart'. This metaphysical view of matter as a substrate which cannot exist without form (cf. Gredt 1937: *numquam est sine forma*) reduces the dualism between material and formal (or 'spiritual') being to a difference of *degree* of being, i.e. potential or actual, rather than to a difference of kind, as in the Cartesian doctrine of matter existing on its own as extended substance.

This substrate of a substance, i.e. of a subject which, in contrast to the substrate, has a nature and properties and which undergoes change, is, *qua* substrate, the 'principle of individuation' in individual substances. It is individual substances which exist in the material world. Yet universal forms or natures alone (i.e. the active *principles* of substances or of their 'accidents') are intelligible, and it is of these that individual *differences* consist. We do not, however, understand the individuals themselves, since all such differences, as accidental *forms*, are transferable from one individual to another. So matter is not even a propertyless (actual) particular at the heart of an individual; as a principle it is distinguishable, but not separable, from all form. Separation may occur from a given form, during change, but not from all form. We could say that this postulating of the unintelligibility of the material individuality of things is an attempt, more or less successful, to explain the way things "escape from language" (H. McCabe's phrase).

The substrate should not be equated with just any *subject* of properties, for this would obscure the understanding of substance, also a subject, as that which primarily exists. Substrate, by contrast, is exclusively the name for an ultimate instance of being a subject. 'Subject', strictly speaking, names a being in a relationship; in the given ultimate instance it names that which is the substrate of a substance (although the latter can also, however, be called in turn the subject of its properties). At times, though, 'substrate' can be meant analogically (e.g. as the bronze is the 'matter' of a statue), in place of a literal reference to *prime* matter as such. 'Subject' can refer also to the epistemological subject or ego as well as to the logical subject or, of course, to substance. But substrate, when said literally, refers exclusively to the principle in nature (*ens mobile*) of potentiality, i.e. prime matter (cf. Mansion 1979: "matter . . . the ultimate substrate, which is the ontological support of form"). Correlate with form, it is a principle not only of change or becoming but of present material being (cf. Aquinas, *In Phys.* I, 7 lect. 13, 1–4). Everything comes from the substrate and the form, says Aristotle. The Latin, confusingly, has *subiectum* (from ὑποκείμενον) here and the substrate is indeed the *first* or ultimate subject (as we said above), hence principle, of anything (*Phys.* I, 9, 192a31), hence *materia prima*. Subject, then, is a more general and loose term than substrate.

The substrate, prime matter, is not a body, like atoms or even energy, but a principle of physical reality (even of an atom). It is thus not merely a (negative) principle of cognition and so it seems an error to try to explain this hylomorphic doctrine as a response to the way sentences (and thoughts) are made up (as McMullin tends to do). Rather, the proposition, as an *instrument* of cognition,

> must be a sign of the real being which is to be shown; its composition must signify the composition of the real thing, and its parts must in some way reflect the parts of the real composite (Schmidt 1966).

Subject and predicate reflect matter and (often an accidental) form. How things are, that is to say, inclusive of the substrate, determines the structure of language and predication, and not vice versa. This indeed is the principle interest of the substrate for such as Aristotle, who claims to deduce (and not merely to hypothesize) it as the principle of potentiality in nature.

So it cannot be true that Aristotle just 'takes for granted that predicability is strictly coextensive with ontological determination', since ontological determinations just *are* forms and any form, *qua* intelligible, is predicable. Meanings, for Aristotle, derive from the forms of things, not forms from our system of reference. This is his considered metaphysical theory, worked out in conscious opposition to the Sophists rather than taken for granted (cf. *Met.* IV or *Post. An.* II, 19). *That which* is determined, 'this ultimate subject, is, in its very being, thoroughly indeterminate', since this is just to say that it is potential being, not actual being. The reality of such an entity or principle, the non-actual substrate, follows from Aristotle's analysis of substantial change and the correlate doctrine of the uniqueness (*unicitas*) of the substantial form. That is, the substantial form of a thing 'informs' the substrate directly to make the thing what it is, and does not come to bear upon supposed actual but hierarchically subordinate forms (cf. Aquinas, *Sum. Theol.* Ia, 76, 4 ad3 and articles 6 and 7).

So although, as McMullin (1966) shows, Aristotle's doctrine of the substrate, unlike that of the Ionians, begins with an analysis of predication, it is not plausible to argue that to say that prime matter exists is to say something about predication and not about material being, viz. that it changes. Aristotle is analysing change, not talk about change.

To object to such an indeterminate pure potency in nature that 'it is obvious that a dog cannot change into just anything' confuses natural and logical impossibility. Miraculous changes are conceivable and, if they are not mere replacements (and so not changes at all), they would represent the limiting cases where the continuing subject is quite indeterminate and seen to be so. Ultimately, however, this is the case in all substantial change, e.g. from dog to corpse, if "nothing is absolutely one except by one form, by which a thing has being, for a thing has both being and unity from the same source", and hence "all previous forms disappear with the advent of a substantial form" (Aquinas, *Quodlibet* 1.4.1). The act of being of any one substance is one act. What happens, accordingly, in a normal substantial change is that the *dispositions* of the particular matter, as effects of the old form, are progressively altered in a series of accidental changes until they can no longer coexist with the first substantial form which is replaced by the new, whereupon *all* previous forms disappear (even while the properties remain 'equivocally'), a kind of 'qualitative leap'.

What *is* actual in the substrate is its having an intrinsic disposition to form, i.e. it is not merely nothing, but is potential *being*, somehow prior to any quantity. Nevertheless it is always immediately subject to some quantity or other in the sense that such matter has an "intrinsic ordination . . . to quantity as to a dividing form" (John of St. Thomas). So quantity here is not an inherent form of matter, since the latter is itself without form, but is as it were *ready* to take on quantity as a determinant. The substrate is a condition for compositeness and hence perishability precisely through this susceptibility to quantity, not through *being* a quantity. It can be divided up into *different* quantities, or rather, as principle, take them on; however it is the whole substance, and not the substrate, which is the subject of the accident of quantity.

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STEPHEN THERON

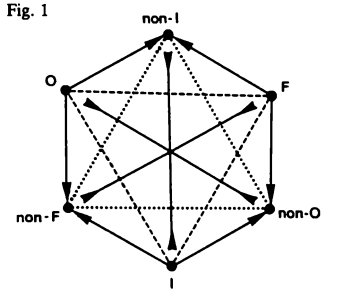
Supererogation

Since at least the time of scholasticism, moral theorists have discussed a certain type of behaviour that can be referred to as *supererogatory*. Behaviour is supererogatory if it surpasses that which is morally or juridically required (the term can be traced back to the Latin version of the Bible, Luke X, 35: "*quodcumque supererogaveris*"). According to most moral theories, he who risks his own life to save another behaves supererogatorily, since he is neither juridically nor morally required to do so. The following text will discuss how to fix supererogation within a consistent system of moral value-judgements.

The moral or juridical value-judgement that a person *P* makes regarding the existence or non-existence of a certain state of affairs *S*, such as the commission or omission of an act, can be interpreted in terms of the relationship between *P*'s moral or juridical standpoint, on the one hand, and *S* itself, on the other. As Alexius Meinong expressed it, it is the relationship between *P*'s "*Werthhaltung*" (literally, 'value-attitude') and *S* (cf. Meinong 1894, p. 66). Various relational patterns emerge from collating the variety of all possible 'value-attitudes' and the class of all past, present, or future *S*'s. These relationships are primarily ontological in nature, since they concern the 'value-attitudes' of real individuals toward real states of affairs. They are as well generated where moral or legal principles are applied in order to influence states of affairs in the future or judge or evaluate states of affairs in the past.

In the simplest case, *P* can evaluate *S* as either positive or negative. His moral or juridical attitudes toward the universe of potential states of affairs then constitute a simple two-dimensional framework. To the extent that *P* can influence the occurrence or non-occurrence of any *S*, he would have to make those acts effecting a positively valued *S obligatory* and those effecting a negatively valued *S forbidden*. Although past *S*'s can no longer be affected by *P*, what is obligatory and forbidden will still be relevant retrospectively in passing moral or legal judgement. Within a two-dimensional evaluative framework, no act causing *S* exists that *P* would not consider either obligatory or forbidden. Strict act-utilitarianism is an example of this kind of evaluative framework. Accordingly, any possible action is either obligatory because it has positive utility, or forbidden because it has negative utility, assuming, of course, that no two actions have the same utility. One also may say that (1) what is not obligatory is forbidden, and conversely (2) what is not forbidden is obligatory.

Fig. 1



O = obligatory; F = forbidden; I = indifferent = absolutely permitted; non-O = not obligatory; non-F = not forbidden = relatively permitted = licit; non-I = not indifferent = under duty; → = implication; >—< = contravalence; ··· = disjunction; --- = exclusion.

Usually, however, an individual's evaluations of all possible states of affairs turn out to be three-dimensional, since he will evaluate some *S*'s as indifferent instead of either positive or negative. A person might not care, for example, whether his neighbour does or does not raise roses. Most moral or

juridical systems are based on three-dimensional models of this sort. A hexagon (see Fig. 1) can be formed using these three concepts and their negations that illustrates the logical relationships between them (cf. Kalinowski 1972, pp. 106 ff., 119):

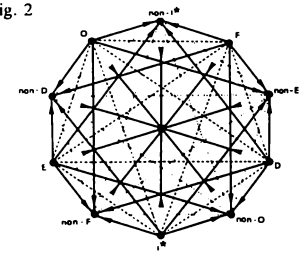
It is clear that *supererogatory* action cannot be adequately reflected in the above-described three-dimensional framework. Supererogatory behaviour is certainly neither obligatory nor forbidden. And since we usually react to such behaviour by bestowing a morally motivated (positive) sanction, such as praise or honour, it also cannot be regarded as morally indifferent.

Meinong seems to have been the first to try to develop a consistent conceptual system that could account not only for obligatory, forbidden, and indifferent actions but also for supererogatory commissions and omissions. In Meinong (1894) (pp. 88 ff.) he uses the metaphor of a "line of moral worth" passing through the "sphere of morality". This line originates at the "zero point of value". In one direction it crosses the "sphere of the good", which is composed of the "value spheres" of the "correct" and the "meritorious". In the other direction it traverses the "sphere of the bad", which includes the "value spheres" of the "licit" and of the "demeritorious". One can conclude from Meinong's examples that he would have included obligatory actions in the sphere of the "correct" and forbidden actions in the sphere of the "demeritorious". The "zero point of value" indicates indifferent actions. Meinong does not use the expression "supererogatory"; yet he states that a difference exists between the "deeds of an Arnold von Winkelried or Decius Mus and such activities as the conscientious performance of one's profession or the keeping of a promise". It is clear from this passage that Meinong views the commission of a supererogatory act as "meritorious" and the omission of such an act as "licit". He thereby simultaneously distinguishes such behaviour from that which is "correct" or "demeritorious". Meinong's system is accordingly based on a five-dimensional evaluative framework of 'value-attitudes' in relation to possible states of affairs. Yet Meinong is not completely successful in accounting for all relevant value-judgement. He is, certainly, correct in supposing that "non-meritorious" and "non-demeritorious" can be identified, respectively, with the disjunction of the four remaining positive concepts. "Non-correct", however, is not equivalent to "meritorious or licit or demeritorious or indifferent"; nor is "non-licit" equivalent to "meritorious or correct or demeritorious or indifferent".

Building on Meinong's theses, R. M. Chisholm also developed a five-dimensional evaluative framework for the analysis of our moral/juridical 'value-attitudes'. Chisholm classifies actions as "obligatory", "wrong/forbidden", "indifferent", "supererogatory", or "offensive". From the negation of the expression "offensive", however, one sees that his five-dimensional conceptual system also is not totally consistent since "non-offensive" cannot be identified with the disjunction of "obligatory", "wrong/forbidden", "indifferent", and "supererogatory".

A complete and consistent systematization of our moral 'value-attitudes' in relation to states of affairs can be attained only if one differentiates between coercive prescription (*praecepta*) on the one hand and non-coercive advice (*consilia*) on the other as they were distinguished by the scholastic tradition (cf., e.g., Thomas Aquinas, *Sum. Theol.* I–II q 108 a4). One must further differentiate between positive advice or 'exhortation' and negative advice or 'dehortation' depending upon whether the commission or omission of the act is considered to be supererogatory.

Fig. 2



E = exhorted; D = dehorted; non-E = not exhorted; non-D = not dehorted; I* = indifferent; non-I* = not indifferent; see also legend to diagram above.

The logical relations among these concepts

and their negations can be seen in the decagon (Fig. 2) (cf. Hruschka and Joerden 1987, pp. 93 ff.).

One should note that "indifferent" here is a new notion. In the decagon "indifferent" (I^*) does *not* include 'exhortations' and 'dehortations' and thereby supererogatory commissions and omissions as does the concept "indifferent" (I) introduced in the hexagon above. Among other things, the decagon shows that a supererogatory act or omission is always relatively permitted, as well as non-obligatory (cf. the implications from E and D to non-F and non-O) and that it is not (morally) indifferent (cf. the implications from E and D to non-I^*). Finally of interest is that one can draw a symmetrical axis from I^* to non-I^* with the result that all of the operators to the left or right of this axis can be transformed into their reflected counterparts on the other side of it. This transformation can be accomplished by changing the modified concept from the commission of an act (a) to its omission (not-a) and vice versa, e.g. $O(a) \rightarrow F(\text{not-}a)$, $E(a) \rightarrow D(\text{not-}a)$. This symmetrical relationship between operators corresponds exactly to what Meinong (1894, p. 89) referred to as the "law of omission", which he considered necessary to the logical relationship between moral judgements.

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JAN C. JOERDEN

Supervenience

The basic idea of 'supervenience' goes back at least to G. E. Moore (1922) and other ethical theorists earlier in this century, but it was R. M. Hare (1952) who brought this term into philosophical currency by explicitly invoking the 'supervenience' of moral predicates in his meta-ethics. As Hare explained it, ethical predicates, such as 'good', are "supervenient predicates" in that no two things (persons, acts, or states of affairs) that are alike in all descriptive respects can differ merely in that an ethical predicate applies to one but not to the other. Moreover, according to Hare, this feature of supervenience is a distinctive characteristic of all *evaluative* predicates, including aesthetic ones, such as 'beautiful'. A further important idea soon became associated with supervenience, and this was the doctrine, defended by both Moore and Hare, that in spite of the supervenience of the moral on the descriptive, the former is *irreducible* to the latter.

Although the idea of supervenience thus originated in moral theory, it naturally lends itself to generalization as a relation between any two sets of properties (Kim 1978, 1984), and this is what makes it a concept of interest to metaphysics. D. Davidson (1969) was among the first to exploit this possibility with his thesis that the mental supervenes on the physical in that "there cannot be two events alike in all physical respects but differing in some mental respects". Significantly, Davidson, too, coupled his thesis with the claim that the mental is irreducible to the physical.

The core idea of supervenience then was this: things that are exactly alike in respect of the 'base' or 'subvenient' properties must be alike in respect of the 'supervenient' properties. Two desiderata, however, have come to be closely associated with supervenience. First, supervenience is to be a relation of *dependence* or *determination* in the sense that what supervenes is dependent on, or determined by, that upon which it supervenes; and yet, second, it is to be a *non-reductive* relation, one that does not entail the reducibility of supervenient properties to their base properties. The question remains,

however, whether the core idea of supervenience can simultaneously satisfy both these conditions.

Recent studies have shown that supervenience as initially characterized by Hare and others is not a unitary relation but a family of distinct relations of varying strength. Thus far, 'weak', 'strong', and 'global' supervenience have been distinguished (Kim 1984). Let A and B be two nonempty sets of properties closed under Boolean operations (including infinite conjunction and disjunction). Consider:

> *A weakly supervenes* on B iff necessarily any two things that have the same properties in B have the same properties in A (that is, B-indiscernibility entails A-indiscernibility).

This captures the supervenience of the moral on the descriptive in the sense of Hare. In various ways, however, supervenience thus defined appears quite weak as a dependency relation. For consider: it permits a possible world which is just like the actual world in all descriptive details but in which no moral properties are present; similarly, it permits a possible world physically just like ours and yet radically differing in psychological respects (e.g., consciousness is present not in higher animals but in unicellular organisms). For in such worlds no two things indiscernible in non-moral (or physical) respects are discernible in some moral (or mental) respect. A dependency relation that permits these examples has seemed to many to be too weak. Consider then:

> *A strongly supervenes* on B iff for any x and y and any possible worlds w_i and w_j if x has in w_i the same B-properties that y has in w_j then x has in w_i the same A-properties that y has in w_j.

On this definition, the distribution of A-properties over objects in a world is constrained by the distribution of B-properties over objects in *other* worlds as well as in the given world. This generates a stronger relationship between supervenient and base properties: if something has an A-property it has also a B-property such that *necessarily* anything with this B-property has that A-property. Under weak supervenience, it turns out that every supervenient property has, in each world, a base property with which it is coextensive in *that* world; however, the coextensivity may break down in other worlds. Under strong supervenience, however, each supervenient property is guaranteed a base property with which it is coextensive in every world; that is, every supervenient property has a *necessary* coextension in the base properties (Kim 1984). Thus, strong supervenience, but not weak supervenience, entails *strong connectibility* of the supervenient properties with their base properties. (This result depends on the Boolean closure of the base properties.)

It is also possible to analyse supervenience by applying indiscernibility considerations directly to worlds (e.g., Haugeland 1982, Horgan 1982). This yields the concept of 'global supervenience':

> *A globally supervenes* on B iff any two worlds that are B-indiscernible are also A-indiscernible.

Two worlds are indiscernible in respect of a set of properties iff, roughly, the properties are distributed in the same way over the individuals of the two worlds. It can be shown that strong supervenience entails both weak and global supervenience; that weak supervenience entails neither strong nor global supervenience; and that, similarly, global supervenience entails neither strong nor weak supervenience. The model-theoretic notion of 'determination' developed by Hellman and Thompson (1975) is closely related to global supervenience as explained here. The fact that global supervenience does not entail weak supervenience is a ground for doubt concerning its suitability as a dependency relation, at least in certain contexts. Moreover, global supervenience of the mental on the physical is consistent with there being a world that differs from this world in some minimal physical detail and yet diverges radically in psychological respects.

The modality invoked in these definitions of supervenience is best left as a parameter to

be fixed to fit specific applications; e.g., the modality appropriate to moral supervenience may be conceptual or metaphysical; that appropriate to psychophysical supervenience may be nomological.

Does supervenience understood in these ways satisfy the condition that it be a *non-reductive dependency* relation? A reductive relation between two sets of properties is generally thought to require strong connectibility (in the sense explained above) between the two sets.

Weak and global supervenience qualify as non-reductive relations, since neither entails strong connectibility. But strong supervenience entails it; whether strong supervenience is reductive, therefore, depends on the question, still in dispute, whether reducibility requires more than strong connectibility. On the other hand, strong supervenience appears to meet the desideratum as a dependency relation. As we saw, it is debatable whether weak or global supervenience yields a robust enough dependency relation in some of the contexts to which supervenience has been applied. The three supervenience relations are best viewed as distinct dependency relations, each with its own potential for application.

In addition to psychophysical supervenience and the supervenience of the moral on the non-moral, there are many other possible supervenience theses of interest; e.g., mereological supervenience (that the properties of a whole supervene on the properties of its parts) and the supervenience of causal relations on non-causal facts of the world.

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JAEGWON KIM

Surfaces

The concept of a surface was given its first important treatment in Western philosophy by Aristotle, especially in *Physics*, Book IV, 208b–13a. Aristotle asserts that surfaces are boundaries that define the place a material body might occupy, are themselves not bodies or material entities, and function analogously to containers, something like a non-material vessel that encompasses or surrounds a material object existing at a place. Though there have been subsequent disagreements both about the kinds of boundaries that surfaces are and whether they function as 'containers', Aristotle's claim that they are boundaries has been widely accepted down to our own time, including his suggestion that surfaces are essential in defining the nature and limits of material objects (on this latter point, see H. H. Price, *Perception*, 1932, p. 35). An important, early modern thinker who disagreed with Aristotle was Leonardo da Vinci (1452–1519). Though concurring that surfaces are boundaries, Leonardo argues that they are the interfaces (common boundaries) between contiguous objects or states of matter rather than containers. He says: "it must needs be therefore that a mere surface is the common boundary of two things that are in contact" (*Notebooks*, pp. 75–6). Leonardo also agrees with Aristotle that surfaces lack "substance" or "divisible bulk" and are thus non-material entities. In modern parlance, he seems to have held surfaces to be abstractions, much as the equator is an abstract entity, a common boundary, that divides the earth's two hemispheres from one another. Still another con-

ception of surfaces, different from either of the above, arose in the early part of the 20th century as a consequence of developments in the theory of perception. Though it was accepted that surfaces were boundaries, it was argued that they could not be abstractions, since by definition abstract entities, like the equator or numbers, are not visible. Surfaces thus had to be physical parts of physical objects, that "part of something that is presented to a viewer with little or no examination" (*Webster's Third New International Dictionary*, p. 2300), in order to be seen at all. A differing conception of the ontological status of surfaces thus emerged as a by-product of epistemological enquiries into the nature of our knowledge of the external world. The main issue, with scepticism looming in the background, was whether our perception of the external world, including our perception of the surfaces of opaque objects, is direct or indirect. Important contributions to this debate were made by G. E. Moore, Thompson Clarke, and J. J. Gibson. Moore argued that we see the surfaces of opaque physical objects directly, but the objects having those surfaces indirectly. In "Seeing surfaces and physical objects" (1965), Clarke rejected Moore's conclusion, arguing for a strong form of direct realism, namely that we perceive physical objects directly. Like Clarke, Gibson defended a theory of direct realism, and claimed that in normal cases of perception one sees both the surfaces of objects and in so doing the objects themselves directly (*The Ecological Approach to Visual Perception*, 1979, Chapter 9). Many contemporary theorists now agree with Moore that the perception of physical objects is never direct. Instead, they speak of mental representations or phenomenal visual space as being directly perceived, and of external objects, which are the physical causes of such representations, as being indirectly perceived, frequently advancing arguments about the distortions caused by the processing mechanisms in the eye and the brain in support of this latter inference. An example of such a view is to be found in Robert French's "The geometry of visual space (*Noûs*, 21, 1987, 115–33). French holds that:

> we are never immediately aware of even the surfaces of physical objects . . . and that our immediate awareness consists of a phenomenal field of colors, visual space (p. 115).

Despite the extensive references to surfaces in the philosophical literature since the Greeks, there has been surprisingly little systematic analysis of the concept and the only book-length work wholly devoted to this topic is Avrum Stroll's *Surfaces* (1988). Stroll agrees that the surfaces of physical objects are boundaries, but in order to obtain a clear picture of what they are, one must determine what sorts of boundaries they are. It is clear that not every boundary is a surface. A cube, for instance, has twelve edges and six surfaces. Its edges and its surfaces are boundaries, but since there are more edges than surfaces, some edges are not surfaces, and therefore some boundaries are not surfaces. What counts as a surface will depend on the object one is speaking about. Not all physical objects (human beings, clouds, live animals) have surfaces. Many physical phenomena (shadows, rainbows) do not have surfaces. Generally speaking, surfaces are *spreads*, i.e., something like sheets, being broadly disseminated across an object in two dimensions and relatively thin in another. In the case of a cube, the dimensions of its surfaces are determined by edges, which are *linear extensions*, being as long and as wide as their adjacent surfaces, but thin in a third dimension. Some objects (perfect spheres) have exactly one surface, and no edges. But no physical object can have an edge without having at least one surface. It is also argued that the concept of a surface is ambiguous between interpretations of them as abstractions or as physical entities. In the former respect, they function as the outermost or uppermost boundaries of physical objects without being material; but since surfaces may be pitted or damp, can be scratched or polished, then the surfaces to which such predicates apply must be physical entities. Stroll argues that this ambiguity is embedded in ordinary speech and is not further reducible to some common notion that incorporates both conceptions. He also argues that nearly all of the quasi-topological concepts

that comprise "the geometry of ordinary speech" (boundaries, edges, margins, borders, surfaces, etc.) are ambiguous between physicalistic and non-physicalistic readings. Four further points:

1. The surface of x is never all of x. The surface of a sphere encompasses the whole outer area of the sphere, but the sphere itself is more than its outer aspect since it has an interior.
2. 'Surface' is a contrastive term. To speak about the surface of Y may be to contrast the surface with Y itself, or with the interior of Y, etc.
3. Surfaces do not in general exist independently of the physical objects that have them; though some physical objects, as mentioned above, may exist without having surfaces.
4. Though Latin etymology suggests that surfaces are types of faces, a logical analysis shows that surface-talk mainly applies to the world of the inanimate and face-talk to the world of the animate, though there is some overlap (e.g., bricks can be said to have faces and surfaces).

Comparing the perception of the full moon on a clear night with Venus on a clear night establishes that it is possible to see an opaque object like Venus without seeing its surface, which is permanently covered with clouds. The commonly accepted thesis in the theory of perception that it is a necessary condition of seeing an opaque object that one see at least part of its surface is thus false. This finding also shows that the logic of 'seeing' and the logic of certain physical-operation predicates, such as 'polishing', 'scratching', and 'sanding', are radically different. For as the above result indicates, it is possible to see an opaque object without seeing its surface, but it is not possible to scratch an intact, solid, ivory billiard ball without scratching its surface (and conversely).

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AVRUM STROLL

Syllogism. See: Logic I

T

Tarski, Alfred

Alfred Tarski was one of the foremost logicians of this or any century. Born Alfred Tajtelbaum in Warsaw in 1901, he studied mathematics and philosophy there, his teachers including the philosopher Tadeusz Kotarbiński (1886–1981), the mathematician Wacław Sierpiński (1882–1969), and the logicians Jan Łukasiewicz (1878–1956) and Stanisław Leśniewski (1886–1939). Tarski's 1923 dissertation showed how Leśniewski's protothetic could be based solely on material equivalence and quantification, and from this point on he was in the forefront of logical research. By chance in America at the outbreak of war in 1939, he remained there, teaching from 1944 until 1973 at the University of California, Berkeley. He died in 1983. Tarski's work directly influenced two generations of mathematicians and logicians and the breadth of his interests and influence is unsurpassed in this century.

Tarski made fundamental contributions to many areas of logic, metalogic, and metamathematics, especially the theory of deductive systems, logical consequence, truth, decidability, algebraic logic, and model theory; also to algebra, set theory, and to geometry and its foundations. He was an

excellent teacher with numerous brilliant pupils, with many of whom he collaborated in joint works. Tarski wrote in a limpid, unadorned, and accessible style.

Tarski regarded himself as a logician and mathematician rather than a philosopher, and spoke or wrote sparingly in public on philosophy. In private he expressed himself more willingly; his views were influenced by those of his philosophical mentor Kotarbiński, and tended towards an extreme nominalism (cf. Suppes 1988), which sits uneasily with his unabashed use in mathematics of systems apparently committed to large domains of abstract objects, a tension unresolved in the published writings. Unfortunately, Tarski's reluctance to publish in philosophy means that we do not have justifications from him for interesting views which he was known to hold, such as his extensionalism, or his denial of a sharp distinction between logical and empirical truths, in which he antedated W. V. O. Quine. His work shows a remarkable continuity: topics such as the limits of logic, the calculus of relations and the algebraicization of logic occupied him over several decades.

Tarski's investigations and methods in metalogic permeate most subsequent work in these areas. He gave the first precise axiomatization of the metalogical concept of consequence, and defined a deductive system as a set of sentences closed under consequence. His first accounts of consequence were proof-theoretical, but after 1933 he moved towards semantic definitions, the most famous being that of 1936:

> The sentence X follows logically from the sentence of the class K if and only if every model of the class K is also a model of the sentence X.

He placed the theory of definability on a firm basis, giving a precise formulation and justification of Alessandro Padoa's method for showing indefinability of a primitive concept in terms of others, and defining the expressive completeness of a set of primitive concepts.

Tarski's work on decidability produced surprising positive results, the decidability of elementary geometry and the elementary theory of real numbers. His work on the foundations of geometry included a precise axiomatization of solid geometry in terms of the two notions of sphere and part-whole. In 1924 he and Stefan Banach (1892–1945) proved the paradoxical result that, if the axiom of choice is assumed, a sphere can be finitely decomposed into pieces which can be reassembled to form two spheres of the original size.

Tarski's most widely regarded and influential and yet most misunderstood work is the monograph *The Concept of Truth in Formalized Languages*, first published in Polish in 1933, and enlarged and translated into German in 1935. It is one of the single most important philosophical works of this century. Tarski's aim is "to construct – with reference to a given language – a materially adequate and formally correct definition of the term 'true sentence'". A theory is *formally correct* if it is consistent. The concept of truth had been so severely shaken by the semantic paradoxes that philosophers such as Rudolf Carnap were proposing to do philosophy without it. Tarski, following Leśniewski, analysed the paradoxes as arising from the semantic closure of languages: their expressive means allowing them to refer to their own expressions and predicate semantic properties of these. Colloquial languages being semantically closed, Tarski saw no hope of defining a formally correct truth predicate for them and confined his attention to formalized languages. This pessimistic view has been questioned: Tarski was concerned with whole languages for which the classical metalogical principles of non-contradiction and excluded middle obtain. If either fragments are considered or the classical principles are rejected, more can be achieved.

Tarski adopted a clear object language/metalanguage distinction and required the object language to be substantially weaker in expressive power than the metalanguage. To ensure the predicate defined is *materially adequate*, i.e. meets our expectations on a theory of truth, Tarski required all sentences of the form

(T) x is true if and only if p

to be consequences of the truth theory for a language L, where 'x' is to be replaced by a metalinguistic name denoting a sentence of L and 'p' by a translation of this sentence into the metalanguage. Schema (T), misleadingly dubbed 'Convention (T)' by Tarski, has popularly been mistaken for his theory of truth itself.

The most influential part of the paper is the brilliant recursive definition of 'true sentence' in terms of satisfaction by an infinite sequence of objects. This method was forced on Tarski by the circumstance that in the languages in question there are infinitely many expressions and the sentences of the metalanguage are only finite in length. Tarski illustrates the method in detail for a simple example, the algebra of classes, and indicates how it can be extended to other languages of finite order. He stresses that the method *eliminates* semantic concepts. This is questionable, since he presupposes that the object language is interpreted and translatable into the metalanguage. For languages of infinite order he initially regarded the method as inapplicable, and envisaged instead an axiomatic theory taking 'true' as an undefined primitive. The subsequent admission of metalanguages of transfinite order allowed this restriction to be lifted. The most significant metalogical result of the enlarged German version is the theorem, based on Kurt Gödel's incompleteness results, that the definition of truth in Tarski's sense cannot be given if the metalanguage does not contain variables of higher order than all those of the object language, in particular, that the set of arithmetical truths is not definable in arithmetic.

See also: **Truth Theory**

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PETER M. SIMONS

Technology

Natural and Cultural Determinants. Lacking fixed instincts and highly specified organs, man is by his very nature forced to produce technical artefacts in order to cope with a hostile environment; he is the tool-making animal (B. Franklin) or the *homo faber* (H. Bergson). Basic tools are 'projections' of our organs and technical routines result in engrained habits that relieve us from having to master each changing situation anew. What technological artefacts and instruments provide must in one way or another be reduced to the reach of our body and our sense organs in order to be useful to man. In this naturalistic perspective the technology man puts between himself and the physical world appears as a biological and instinctual phenomenon rather than as a theoretical and cultural achievement.

The development of technology can be seen as an evolutionary process in which each new species of artefacts surpasses its predecessors in efficiency. The services modern technology provides strike a resonant chord with potential human desires, producing ever new needs which the latest technological conveniences may satisfy. On the other hand, economic competition tends to result in a quasi-autonomous technological change which tends in turn to level cultural differences and to foster the emergence of a unified world civilization.

This historical process is not subject to any nomic necessity of the laws of nature. Elevating technology to the rank of an autonomous subject and ignoring the acting individuals amounts to a fallacy of misplaced concreteness. Everything that exists in the realm of technology has been created by man and is therefore dependent on his dominant values and goals at any given time. Hence any one-dimensional explanation of technological development in terms of 'materialist' or 'idealist' factors alone is an oversimplification.

By its very nature technology has a natural *and* a cultural, a biological *and* a historical, a factual *and* a normative aspect.

One can identify certain mental prerequisites for the rise of the modern machine-based technology as opposed to the 'organic' technology of traditional societies. These include the appreciation of work, the idea of progress, reification and the mechanistic view of nature, as well as mathematical representation and experimental method. Technology is hereby dependent on ideas. But there is also the obverse influence of technology shaping the image man has of himself. This is visible in René Descartes's interpretation of man as an automaton, in Thomas Hobbes's mechanistic theory of the state, in Sigmund Freud's idea of the conservation of psychic energy, as well as in the cognitive psychologist's view of man as an information-processing system.

Metaphysical Explanations. In the intellectual tradition of Western philosophy, technology was regarded as a craft or at best as a mere application of scientific findings, not deserving philosophical investigation. Even after the industrial revolution, the need for an investigation of the philosophical problems of technology was not recognized. Only recently, in connection with its negative undesired results, is technology gradually attracting philosophical attention. The philosophy of technology results from the intersection of different ontological dimensions; it must relate simultaneously to value-patterns, the structure of knowledge, social activity, and the historical process. Since it must consider such heterogeneous dimensions, the philosophy of technology differs from those more traditional areas of philosophy that are confined to a narrow, well-defined topic.

One can distinguish four basic metaphysical interpretations of technology:

1. The *naturalistic view* draws on man as a part of nature and is thus straightforwardly opposed to the traditional understanding of man as the *animal rationale* based on a predominance of reason. The view appears in different forms. That technology has biological determinants and results in the extension of our bodily constitution is stressed by Ernst Kapp (1808–96) and Arnold Gehlen (1904–76); that it is brought about in the historical process of production of material goods is stressed by Marx and his followers; and that it may be interpreted as a conscious and deliberate reconstruction and continuation of biological evolution is an idea stressed by Hans Sachsse (born 1906) and Serge Moscovici (born 1935). The naturalistic approach has the merit of drawing attention to the natural and material side of technology. But a view of technology as part of nature can hardly explain the dynamic expansion of modern technology, which is based on science and information processing. This expansion has been brought about through the application of rational procedures and through adherence to attitudes and values that are culturally determined and not imposed by the natural environment. The milieu to which modern man adapts is primarily man made; the alleged natural adaptation hereby becomes transformed into a cultural self-adaptation.

2. The *rational interpretation* of technology relies on the creative acts of invention and on the systematic procedures that are characteristics especially of modern technology. This approach begins with the conceptual, theoretical element of technological creativity and even claims an analogy with the divine creative activity (Friedrich Dessauer, 1881–1963). In terms of the traditional distinction between matter and mind, this interpretation is the opposite of the naturalistic view. No longer is nature treated as the ultimate source of development; rather, the intellect is taken to fulfil its destiny in ruling over matter. There are good reasons for lending support to both interpretations, which may be said to complement each other. Independently of their metaphysical assumptions, the proponents of both usually incline to a positive and fairly optimistic interpretation of technological development. They are convinced that a higher principle, be it evolution or god, will guarantee a positive outcome.

3. The *cultural explanation* of technology seeks a more comprehensive understanding by putting technology into the context of other elements of culture, such as language, art, religion, science, or historical tradition,

all of which participate in the 'totality and universality' of intellectual life (Ernst Cassirer, 1874–1945). In this view, technology is not primarily defined by its instrumental function. Rather, it is seen as an expression and manifestation of a universal creative impulse that leads to the various 'symbolic forms' of a given society. Technology is today bound inseparably to the cultural life of society. The result is a growing tendency to subordinate patterns of thought and general views of life to the dominating technological conditions.

4. The final metaphysical analysis of technology turns on the *volitional impulse*, i.e. the Promethean drive to bring about ever new technological means not necessitated by basic biological or cultural needs. In this speculative interpretation it is the will to power that constitutes the ultimate reason for the constant intensification of modern technological development. In Martin Heidegger's view, the remedy for this hypertrophic volitional impulse must consist in what he calls a 'recollection of being' and in a contemplative, relaxed attitude.

In our secularized society, technology has become an object of infinite admiration or of absolute condemnation. In fact either of these interpretations can appeal to the Western intellectual heritage. The technological trends of the Renaissance and the Enlightenment are as much part of our tradition as are the opposed trends in Romanticism and Existentialism. Modern technology is an integral part of the world in which we live. It concerns man as a part of nature and it is based on intellectual creativity; it shapes our physical surroundings and it determines our style of life and even our self-image; it provides material means both for a higher form of existence and for the destruction of our natural environment.

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FRIEDRICH RAPP

Teleology

Teleology names the property of objects whose behaviour is or appears to be directed at attaining or maintaining some goal, purpose, end, or aim. Teleological systems also include ones to which 'functions' are accorded. Such behaviour is manifested in human action, and by organisms, and their components, organs, tissues, cells, and subcellular organelles. Advances in technology have also given currency to teleologic descriptions of complex mechanical ar electronic devices, such as steam engin governors, guided missiles, and computers.

Aristotle held that the purpose a thing served or its goal could provide at least one sort of (or part of the) causal explanation of its behaviour. He called such goals 'final causes' (*Physics* II). The philosophical problems surrounding this claim emerged in the scientific revolution of the 17th century. They were first raised most pointedly by Spinoza (*Ethics*, Appendix I). Since Newtonian mechanics seems capable of explaining the motion of bodies by appeal only to their position and momentum and without reference to the purposes their motion might serve, teleological explanations became gratuitous in physical science. Spinoza extended this exclusion of goals from scientific explanation in all areas, including biology and human behaviour. His argument is one defenders of teleology have had to face ever since: goals are effects of the behaviour they are alleged to explain; what is more, they are often later effects. But how can future events bring about past ones? Even worse, sometimes an organism engages in goal-directed behaviour and yet fails to attain its goal. Here

teleological explanation cites an event that never happens in order to explain one that does. Causes never operate subsequent to their effects, so if the explanation of behaviour is to be causal, it cannot appeal to future states, still less to ones that do not obtain at all.

Thus, the chief philosophical problems about teleology are:

1. whether there is a distinct sort of teleological causation or determination, in addition to or instead of the prior causes countenanced by physics; and
2. if not, whether teleological descriptions and explanations are nevertheless in some way legitimate.

Negative answers to 1. must come to terms with the important role that function attributions play in modern biological science, and with the apparent explanatory power of purposes in the explanation of human action. This makes question 2. especially important. If an analysis of purposive statements or functional explanations can show how these forms are in principle translatable into conventional causal claims, then teleology will be reconciled with physics. If not, short of jettisoning a good deal of biological science, we shall have to accept the irreducible existence of purposes, goals, and ends that mysteriously determine activities causally prior to them. This would be to widen fundamental metaphysical categories beyond those recognized by metaphysical materialism.

Attempts to analyse teleology into conventional causal mechanisms take two paths: one is inspired directly by Charles Darwin's approach to the explanation of apparent design in nature. Thus, following Larry Wright, the function or goal of behaviour *b* is to bring about or maintain goal-state *g*, if and only if

(1) behaviour *b* (at least frequently) brings about goal *g*; and
(2) *b* is an instance of a type of behaviour that occurs because it tends to bring about *g*.

For biological functions or goals, the second clause in turn is explained by appeal to natural selection: behaviour *a* of the type exemplified by *b* is heritable and has been naturally selected for in the past because its bearers have had greater reproductive fitness (as a result of attaining *g*). In the case of artefacts with functions, selection reflects conscious human choices instead of blind natural processes. Either way the process is a matter of prior causes.

A second popular alternative decomposes apparently goal-directed systems into components that are not goal directed but interact in feed-back and feed-forward causal chains to produce the appearance of goal directedness. In such systems deviations in the value of a causal variable relevant for maintaining a system in its goal state, or on a path towards its goal state, may take the system out of its goal state. But this change causes adjustments in other variables which have the effects of compensating for the initial change, or causing the original variable to resume its prior value. Thus the system is kept on track. It is then, in the words of one of its chief proponents, Ernest Nagel, a "directively organized" system.

On either of these two accounts, teleological processes are, after all, a species of causal process. And their scientific and methodological intelligibility is assured. However, both approaches have been subject to alleged counterexamples. Moreover, an indefinite number of behaviours or sets of feed-back/feed-forward system can bring about the same goal, so there is no assurance that we will always be able either to identify all these alternatives, or express them in a definite set of physical laws. This fact has led some, like Charles Taylor, to conclude that the reducibility of teleology to physical processes is an unwarranted dogma, and that such processes must instead be viewed as an irreducible category of explanation and determination, thus undermining a materialistic metaphysics. Materialists who doubt the reducibility for the same reason, conclude that there is after all no room for teleology in nature, and that our employment of such notions must be explained away, instead of simply explained.

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ALEXANDER ROSENBERG

Telesio, Bernardino

Bernardino Telesio was born a nobleman's son in Cosenza in 1509. Having studied philosophy and medicine at Padua, he worked out a philosophy of nature based on sense-perception and hence opposed to what he called "Aristotle's void reasonings". This philosophy he published in his *De natura rerum iuxta propria principia*, the third and authoritative edition of which was published in 1586 (critical edition Cosenza and Florence 1965, 1974, and 1976). Telesio died in 1588. Many of his teachings concerning nature were taken over by Francesco Patrizi (1529–97) and Tommaso Campanella who, by way of intermediaries like Pierre Gassendi and Walter Charleton (1620–1707) handed his new doctrine of space and time down to Sir Isaac Newton and Kant.

Telesio's philosophy is naturalistic, i.e. in order to explain what is going on in nature, he accepts only principles immanent to nature itself. These are three in number: *heat* and *cold*, which he calls incorporeal (since no bodily mass is perceived to move when they enter into things), and *matter* or corporeal mass. The first two, and especially heat, are active powers; they induce changes in matter, which as such is purely passive, and has no power to generate anything new. Hence the total amount of matter remains the same through all natural processes, and these processes themselves consist only in a different shaping and arranging of the parts of matter to which different degrees of heat and cold are applied.

The primary seat of heat is the sun, that of cold is the earth, and the course of nature results from the antagonism of these two forces interacting in the realm between earth and sun. There are two general parameters underlying this process: space (or 'place') and time. In contrast to Aristotle, Telesio affirms that these are not tied to bodies and their movements, but rather have a substance-like existence of their own. Though we do not perceive (void) space and time, but always things present in them, none the less the predicates characteristic of things are not those of space and time themselves, since they radically differ from those of everything contained in them. They are incorporeal and homogeneous throughout, whereas things are corporeal and differ qualitatively. A given part of space remains immobile when things move into it or leave it; it is nothing but an ability to receive them. Also time has no distinctions in itself; rather, distinguishing predicates like now or earlier or later are applicable only to things that exist in time.

On the basis of these principles, Telesio sets out to explain a great number of natural phenomena (see his *Varii de naturalibus rebus libelli* of 1590, critical edition Florence 1981) and above all the nature of man. Man though in some sense an exception – he possesses an immortal and immaterial soul infused directly by God – is none the less part and parcel of nature. He has a material body, in which moreover a likewise material (fiery) spirit dwells. The principle governing this spirit's actions is self-preservation. In order to avoid hurtful influences from the outside, and in order to discern agreeable ones, the spirit tries to perceive things in its surroundings or, in the case of things too distant for perception, to grasp them by means of the intellect. The intellect is an auxiliary function brought into play in those cases where the senses fail. Furthering its self-preservation is the spirit's supreme good. Self-preservation causes pleasure, and virtue consists precisely in activities that ensure such lasting pleasure.

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KARL SCHUHMANN

Tendency

The concept of tendency is closely related to those of inclination, propensity, power, potency, disposition, and potentiality. Sometimes these concepts are treated as being more or less synonymous, sometimes each is given a specific meaning. When 'tendency' is so treated, as it is by some modern philosophers, it is usually characterized in one of two interdependent ways:

1. a tendency is an entity which can be counteracted by other tendencies,
2. a tendency is a potentiality which may be exercised without being realized.

It is a well-known experience that sometimes, at one and the same time, one wants to perform two incompatible actions between which one is not able to choose. Taken at face value, such a situation shows us two tendencies (the wants) which cancel each other out so that nothing is done. The tendencies to act are there, but there is no action. Similar situations abound in physics, as when two equally large forces act on a body, but in opposite directions. The forces act so that the body is given a tendency to move in each direction, but the tendencies cancel each other and the body does not move. When tendencies counteract each other it may be said that they are exercised but not realized. On the other hand, the only natural way to explain the expression 'exercised without being realized' is to talk of cancelling counteraction. Of course, a tendency may also be cancelled in the sense that for some reason it vanishes, but then it is not even exercised.

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INGVAR JOHANSSON

Tense Logic

Tense logics (or temporal logics) belong to the vast class of intensional logics. Such a logic uses sentential operators O such that the truth value of O $(A_1,\ldots,A_n)$ is not determined by the truth values of the subformulae $A_1,\ldots,A_n$ – in contradistinction to the usual extensional truth-functions of the propositional calculus. E.g. $<(A,B)$ means 'A is the case before B', and if A and B are both true, then $<(A,B)$ may still be false or true; the truth of this composed sentence is not determined by the truth of both A and B.

How can we give a truth definition (a semantics, a model theory) for intensional logics? The desired truth definition must be an extension of the classical Tarskian semantics for purely extensional languages, since intensional languages are also closed under ordinary truth-functional operators (e.g. $<(A,B)\vee\neg<(A,B)$ is well formed and should turn out to be true in every intensional model).

The prototype of an intensional logic is modal logic. As is well known, Saul Kripke succeeded in extending extensional model theory to a formally satisfying model theory for modal logics. The models for tense logics are special Kripke models. Recall first, that a Kripke model is given by a collection W of 'possible worlds' (or more neutrally speaking of 'indices', 'states', or 'reference points') together with a binary relation R on W. At each world $\alpha \in W$ there obtains a classical, extensional structure. For $\alpha \in W$ one can then define by recursion on complexity the truth values of each formula at the world α. The clauses for the extensional operators are as in extensional semantics; the clause for the necessity operator $\Box$ reads:

> $\Box A$ is true at α iff for all β such that $\alpha R\beta$: A is true at β.

Varying the properties of R, we can make different modal laws valid, i.e. true at every world of every Kripke model whose R-relation has the properties in question. E.g. if R is reflexive, then $\Box A \rightarrow A$ is valid; and the transitivity of R makes $\Box A \rightarrow \Box\Box A$ valid.

The ontological problems which can be raised concerning a Kripke model (W,R) are twofold.

1. What is the ontological status of the elements of W? Is the model associated

with α really a world? Or more generally: is the model associated with α a device for defining the truth of the intensional formulae in question that we can take ontologically seriously?

2. What is the ontological meaning of $\alpha R\beta$, i.e. of the proposition that the reference point α stands in relation R to the reference point β?

1. is not specific to Kripke models, since it includes the problem of the ontological meaning and adequacy of the usual extensional structures.

The usual answer to 2. consists in rendering $\alpha R\beta$ as 'β is accessible from α'. This is a quite general answer; its more definite form depends on the intensional logic one wants to model. In the case of the logic of necessity an ontologically acceptable meaning of $\alpha R\beta$ would be: from the states of affairs comprised in α there is a real (objective) road to the states of affairs comprised in β. If one wants to model epistemic logic (with the operator K such that KA means 'A is known'), then $\alpha R\beta$ may mean that knowledge of the states of affairs in α does not exclude the obtaining of the states of affairs in β.

Now, models for languages with temporal operators are, formally, also Kripke models (W,R). Here the set of 'possible worlds' is best conceived as the set of either periods (intervals) or points (instants) of time. To each point or interval is associated a classical structure: if a formula A is true at α (i.e. true in the structure associated with α), then A is true in the point or interval α. The relation R is an appropriate ordering of the time pieces; e.g. the earlier-later relation in the case of time points. Thus the accessibility relation of temporal Kripke models is simply temporal succession, if the set W consists of the time points. Let now GA mean that A will be the case at all points in the future. Analogously to the truth definition for $\Box A$, we can define:

GA is true at α iff for all β such that $\alpha R\beta$ (i.e. for all β later than α): A is true in β.

And if HA means that A has been true at all points in the past, we define:

HA is true at α iff for all β such that $\beta R\alpha$: A is true in β.

As in modal logic, the set of valid formulas of a temporal logic depends crucially on the properties of R, i.e. on the properties of the time orders. Some examples follow below.

Let us concentrate on the case that our time pieces are time points, or instants (without extension). The first ontological question is of course whether there *exist* time points or not. Nobody seems to have encountered one. Anyhow, suppose there exist time points. The second question is whether they can do their semantic job. For, the structures associated with time *points* seem to be as extensionless as the time points themselves. So we must ask whether these structures can make sentences true or false – obviously not always; take e.g. the sentence A = 'John will be swimming for two hours'. Then A will be true at α if there is some later β such that 'John is swimming for two hours' is true at β, i.e. true in the structure associated with β. But it seems to be impossible that a sentence describing a temporally extended state of affairs is true in a structure which has no interna temporal extension. (If the structures ha internal temporal extension, what would i mean to associate them with time *points*?)

Some sentences, however, may be true at some time points and false at others, e.g. the sentence 'John starts swimming', or the sentence 'the particle p moves with velocity v'. And for someone who thinks that all facts can be analysed into point-like facts, time points with their associated temporally atomic structures will be totally adequate.

In any case there are at least some sentences which can directly be modelled in Kripke's structures with time points. Mathematically, time points may be constructed as limits of time periods (see van Benthem 1983). Ontologically, time points seem to be inherent boundaries of singular time intervals. Taking the notion of a time point ontologically seriously, we may consider the question of their ordering, i.e. the question of what properties are possessed by the relation of temporal succession $<$.

First we may assume that $<$ is linear (i.e. irreflexive, transitive, and comparable). Within linearity there are several further supplementary properties. The time order $<$ may be characterized by:

1. Beginning (there is a <-first time point)
2. Ending (there is a <-last time point)
3. Non-beginning
4. Non-ending
5. Dense (between any two time points there is a third one)
6. Continuous or complete (like the real line).

Different properties of the time order < give rise to different valid formulas; e.g. if time is non-ending, then $GA \rightarrow \neg G \neg A$ is valid; if time is dense, then

$$\neg G \neg A \rightarrow \neg GG \neg A$$

is valid.

Linearity of time is assumed, e.g. in historiography and in everyday physics, both of which assume, moreover, that time is dense or even continuous. Nevertheless, there seems to be no *a priori* ontological reason why time points should be linearly ordered. Furthermore, non-linear time order seems to be a necessary result of a causal theory of time. To define temporal succession by causal accessibility was attempted by Leibniz and again by Kant; A. A. Robb in 1914 succeeded for the first time in giving a mathematically non-trivial causal theory of time and its order.

The oldest kind of non-linear time order is the cyclic time order. The time points are ordered in a finite cycle; so there are only finitely many time points (this order cannot be linear, since it cannot be both irreflexive and transitive). Unfortunately, tense logic with cyclic time becomes trivial, since we get $GA \leftrightarrow HA$ as a valid formula. Cyclic time may none the less be the true time order; moreover, one may also prove that there is a causal theory of time that leads to cyclic time order. The proof runs as follows.

Suppose that the causal relation $a\ C\ b$ ('a causes b') holds between *individual* states of affairs (not between *types* of states of affairs) and that C is the *exact* causation relation by which we mean that if $a\ C\ b$ then

1. a is sufficient for producing b
2. no proper part of a is sufficient for producing b
3. nothing properly containing b is caused by a

$a\ C\ b$ defined in this way fulfils the following properties:

i. for every a there is exactly one b such that $a\ C\ b$.
ii. for every b there is exactly one a such that $a\ C\ b$.

i. and ii. together state that the exact causation relation C is a *permutation* of the set of all individual states of affairs. A permutation consists of cycles. If the set of individual states of affairs is finite, then we have only finite cycles. If C consists of more than one cycle, then the world, as the totality of individual states of affairs, is made up of different *causally independent* regions. But this is the same as to say that there are different worlds, since a world must be causally connected. If we define

$$\text{the time of } a < \text{the time of } b =_{\text{Df.}} a\ C\ b$$

then we have a causally defined cyclic time.

Note that it is not necessary here that the time of an individual state of affairs is a time *point*; it may be also an extended time period.

A more modern non-linear time structure is that of branching time. The corresponding temporal logic can be successfully applied to the verification of parallel programmes. In this application, the branching time order gets a causalistic flavour; for if $t_1,\ldots,t_n$ are the time points branching from t, then $t_1,\ldots,t_n$ may be conceived as the states which are accessible from the state t on the basis of the execution of a non-deterministic programme. However, linear time, even in its very specialized form, where it is isomorphic to the order of the natural numbers, is more or less equally useful for the verification of parallel programmes. Computer scientists do not seem to care about the real ontology of time; they are content with the imaginary time inside a computer.

Ontologically interesting is another non-linear time order, that of the Minkowski space-time. Here time and space form an inseparable union, and the order is defined

on space-time points which can be represented by vectors from $\mathbb{R}^4$:

$$(x_0,y_0,z_0,t_0) <_M (x_1,y_1,z_1,t_1) \text{ iff}$$
$$(x_1 - x_0)^2 + (y_1 - y_0)^2 +$$
$$(z_1 - z_0)^2 < (t_1 - t_0)^2 \;\&\; t_0 < t_1.$$

The relation $<_M$ is conceived as a causal earlier–later relation. The special theory of relativity guarantees that $<_M$ holds between space-time points p and q iff a signal can be sent from p to q. This causal relation is of course quite different from the exact causation relation C considered above. Moreover, $<_M$ is not a pure temporal relation. However, detailed ontological investigations may yield the result that there is no pure time, but only space-time. Pure temporal logic will then become ontologically irrelevant.

Thus far we have treated only time *points*, and space-time points. The view of time as consisting of time periods (intervals), however, is perhaps the more natural and concrete one. Also, for semantic purposes time periods seem to be required (cf. our sentence: 'John will be swimming for two hours' above). If one believes in the existence of irreducibly extended states of affairs then one must assume time periods. But these time periods are inherent in these states of affairs as their durations. According to this view, time is not given *a priori*, independently of the concrete states of affairs themselves. One may formulate the slogan:

> The things are not in time, but time is in the things.

Since processes, as components of states of affairs, have in addition to their durations also (instantaneous) beginnings and ends, we can admit also time points as boundaries of time periods. In this way the two approaches to temporal ontology can be integrated.

We conclude with some remarks on the ontological status of the structures which are associated with the time pieces $\alpha \in W$. If one wishes to model only propositional temporal logic, then these structures are nothing but assignments of True and False to the propositional letters. But for first-order temporal logic one must use structures with individuals, functions, and relations. However, these structures cannot be arbitrary. Let $\alpha < \beta < \gamma$ be time pieces in that order of succession, and $S(\alpha)$, $S(\beta)$, and $S(\gamma)$ their associated structures. If there is an individual i in $S(\alpha)$, which is not in $S(\beta)$ but again in $S(\gamma)$, then we have to admit intermittent entities, if we take such structures ontologically seriously. Furthermore, if a sentence of the form $r(a_1,\ldots,a_n)$ is true in $S(\alpha)$, must then the denotata $\bar{a}_1,\ldots,\bar{a}_n$ all belong to $S(\alpha)$? (Think of sentences like 'a_1 is the father of a_2', 'a_1 remembers a_2', and so on.) These problems must be discussed in the framework of a general ontology of change. Before temporal semantics can contribute to this, the following question should be discussed: Are the structures $S(\alpha)$ inherently timeless, so that all predicates involving time, like 'x moves from l_1 to l_2' are excluded from them? If not, then we have two times: one as a relation on the set W of time pieces, the other inside the $S(\alpha)$'s. Perhaps it is the case that time is in t things (the structures $S(\alpha)$) *and* the things i in time.

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J. WOLFGANG DEGEN

Terms. See: Singular Terms

Theodicy, Natural Theology

Natural theology is the attempt to establish propositions about God – e.g., that God exists and has a certain nature – solely on the basis of natural or unaided human reason. The phrase 'on the basis of natural or unaided human reason' specifies both a method and a

source of data for natural theology. Natural theology relies on standard techniques of reasoning and data in principle available to all human beings just in virtue of their possessing reason and sense-perception. It has traditionally been conceived of as the branch of metaphysics dealing with divine being.

A precise characterization of natural theology depends on further specification of its method and data. The strictest conception of natural theology (*strict natural theology*) is based on the Aristotelian model of demonstrative science and restricts natural theology to what can be established by means of arguments with valid logical forms and premisses that are either self-evident or evident to the senses. Strict natural theology contrasts with revealed theology, which takes as data the contents of some supernatural revelation accepted by faith. On the strict conception, natural theology demonstrates or proves in the strict sense propositions about God. Thomas Aquinas took his proofs of God's existence and of certain of the divine attributes – e.g., God's goodness and unity – to be strict demonstrations.

On a broader construal (*broad natural theology*), natural theology relies on weaker conceptions of knowledge and justification than those provided by the Aristotelian model of science. Broad natural theology relies on inductive as well as deductive argument forms and starts from premisses which the proponent of broad natural theology takes to be justifiable on some appropriate criterion of justification. Traditional natural theologians recognized both the strict and this broad conception of natural theology: Aquinas thought that there are good non-demonstrative arguments (so-called 'probable' arguments) for many propositions about God. But post-Cartesian developments in epistemology, which have led to scepticism about the possibility of success in strict natural theology (and about the possibility of successful strict demonstrations in most disciplines other than logic and mathematics), have led philosophers and theologians to abandon strict in favour of broad natural theology. Few of those sympathetic to the traditional enterprise now claim that all the premisses of the traditional proofs are self-evident, and many have developed entirely new approaches. Richard Swinburne, e.g., has developed inductive versions of the traditional proofs for God's existence and used the probability calculus to argue that the explanatory hypothesis of theism is more probable than not; and starting from Alfred North Whitehead's metaphysical views, Charles Hartshorne and others have argued for a form of theism in many ways different from the theism of traditional natural theology.

Many philosophers and theologians have doubted the success of natural theology, whether strict or broad: e.g., David Hume's and Kant's criticisms of the traditional proofs for God's existence are well known. Some have doubted even the possibility of its success. Kant argued that no argument in natural theology could succeed since its alleged object is outside the realm of possible human experience. Theologians such as Karl Barth (1886–1968) have claimed that the Christian God is knowable only in virtue of God's self-revelation and concluded that as a purely human enterprise natural theology cannot arrive at knowledge of the Christian God.

Those convinced of the possibility of natural theology have generally taken it to be compatible with revealed theology in at least three ways. First, some of the content of revelation might also be proved in natural theology. Aquinas held, e.g., that the existence of God is part of the content of the Christian revelation and also provable in natural theology; the doctrine of the Trinity, by contrast, is an example of a datum of revelation not derivable in natural theology. The natural theologian who proves propositions which are among the data of revelation knows them and does not hold them by faith, but the believer or practitioner of revealed theology who does not know such proofs holds the propositions by faith. Second, natural theology might play an apologetic role, i.e., arguments in natural theology might be used to defend theism against objections. Third, natural theology might provide positive justification or a ground for theistic belief by establishing, without appeal to any special revelation, that God exists and has certain attributes.

Philosophers who have agreed that natural theology can at least in principle provide positive justification for theistic belief have disagreed about the importance of this function of natural theology. Some have argued that without the success of natural theology theistic belief would lack the sort of justification necessary for ensuring the rationality of such belief. (Most proponents of this view have not held that in order to be rational in accepting theism each individual believer must engage in natural theology, only that there must be a successful natural theology.) Others have thought that the sort of justification provided by natural theology is not necessary for the rationality of theistic belief. Alvin Plantinga, e.g., has argued recently that belief in God can be properly basic (i.e., can be fully rational without being based on other beliefs), and hence can be fully rational even in the absence of the sort of positive justification natural theology might provide.

Broad natural theology's conception of the acceptable methods of and types of data available to natural theology, however, undermines the ground for a clear distinction between natural and revealed theology. Acceptance of propositions ordinarily thought to be accessible only through revelation may satisfy a criterion of justification weaker than that of strict natural theology: e.g., a weaker criterion may allow the conclusions of arguments from authority into natural theology's data set, and it may be that acceptance of the entire content of revelation can be justified on the basis of arguments of this sort. This blurring of the distinction between the data of natural and revealed theology in part explains recent philosophers' interest in an enterprise (*philosophical theology*) which adopts natural theology's method, i.e., the use of natural reasoning, but rejects any restriction with respect to data. Philosophical theology uses philosophical techniques to examine the coherence and implications of various traditional theistic doctrines – e.g., Atonement, Incarnation, and Trinity – as well as to explore issues ordinarily conceived of as part of natural theology.

The term 'theodicy' seems to have gained currency from Leibniz's use of it in his *Essais de théodicée sur la bonté de Dieu, la liberté de l'homme et l'origine du mal* (1710). Leibniz takes theodicy to be the attempt to defend God's justice or justify God's goodness in the light of the existence of evil in the world. On this construal, theodicy constitutes a part of theistic apologetics. 'Theodicy' can also have a broader sense according to which it means merely the justification or defence of God. On this broader construal, theodicy is sometimes taken to be coextensive with natural theology in its role of providing justification for belief in God.

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SCOTT MACDONALD

Theophrastus

Theophrastus (*c.* 372–*c.* 287 BC) was the pupil and companion of Aristotle, and succeeded him as head of the Peripatos in 323. He shared all Aristotle's interests, and wrote as widely as his master. His two botanical works survive, along with several short works, including his *Characters* and what is now known as his *Metaphysics*. That is probably complete. It contains a number of criticisms of metaphysical views held by Aristotle, Plato, and others. He also, with Eudemus, attacked Aristotle's modal logic, and in his psychology found many problems in Aristotle's account

of the intellect. These views survive partially in Greek commentators and in Arabic works, and had some influence on European 13th-century thought. The fragments of his doxographical work on earlier philosophers also indicate metaphysical interests, and there is evidence that he wrote on theology.

Summary of the Metaphysics, or Study of First Things. What are first things? They are different from the world of nature, and are the objects of reason, not sense. (Here he adopts Aristotle's standard distinction, derived from Plato.) But how are these two related, and what are the objects of reason? They must either be in mathematical objects, or be something prior to these. If the latter, how many are they? He continues in an Aristotelian vein to say that they/it are the cause of motion, but themselves unmoved. They are objects of desire, and cause the rotation of the heavens. But if the prime mover is one, why do heavenly bodies move differently? If there are more than one, how is their influence harmonized? And why does love of the unmoved cause an imitation which is movement? After an interlude about the Platonists, he continues: anyhow the heavenly bodies, having desire, must also have soul, and the movement of soul, which is thought, is better than rotary movement. And what about the inferior parts of nature? And is rotation essential to the existence of heavenly bodies?

He then criticizes Plato, and some of his followers, including Speusippus (died 339 BC), for not carrying through their accounts to the end, but considers a possible reply, that metaphysics is only concerned with first principles. So are first principles definite, or indefinite, in the sense of shapeless and merely potential? At this point it is difficult to be sure whether he is talking of first things in the sense in which the hot, the cold, the wet, and the dry may be seen as first things, or about the fundamental principles (laws) which govern what exists. So when he asks if they are moving or motionless, it could be that the former are in motion but the latter, being abstract, are motionless. In any case, the universe is complex.

Among particular first things are form and matter, one of Aristotle's basic dichotomies. What is the status of matter? This problem was developed in his *De Anima*, in which he pointed out the similarities between prime matter and potential intellect, both being merely potential, and probably explained their differences in terms of how each is related to forms. Other pairs then occupy him, especially good and evil – Why is there so much evil in the world? – and he mentions the void as the contrary of being. But there are different types of being, and knowledge is of similarity in difference at various levels. (Here again he adopts Aristotle's distinctions.) There are different methods of knowledge for different subject.

One must stop somewhere in searching for causes. It is often difficult to assign final causes, as with floods, male breasts, the shapes of inanimate objects, and many other things. Perhaps these result automatically from the rotation of the heavens. Alternatively there is a limit to purposiveness, and the desire for what is good.

Though wide ranging, this is largely a criticism of many of the assumptions on which Aristotle's system is based, and some people believe that it was so devastating that interest in metaphysics ceased in the Peripatos. Theophrastus's successor, Strato (died 269 BC), concentrated on natural science.

Theophrastus's Theology. Cicero (106–43 BC) and Clement of Alexandria (*c.* 150–*c.* 215) say that he identified God with heaven and with mind or spirit. Later writers, Albert the Great (*c.* 1200–80) and Denis the Carthusian (14th century), add more, but their reliability is uncertain. Theophrastus, they say, argued that God had no will (using the Latin term *voluntas*), and that there is a relationship between God and the intellect which is like light. There is also a suggestion that he pioneered negative theology.

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PAMELA M. HUBY

Thom, René

Born on 2 September 1923 in Montbeliard (France), René Thom is one of the most eminent contemporary mathematicians and philosophers. Upon leaving the Ecole Normale Supérieure, he began working with Henri Cartan and Charles Ehresmann in differential geometry and algebraic topology (cohomology and sheaf theory, fibrations and characteristic classes, homotopy, foliation theory, etc.). He was awarded a doctorate in science in 1951 for research on spherical fibred spaces and Steenrod's squares. There he defined and applied what would later be called Thom's isomorphism, and he laid the foundations for what would later become the theory of cobordism. This work was furthered during stays at Princeton where he met first H. Weyl (1885–1955) and, of course, N. Steenrod, then S. S. Chern and, especially, the young Stephen Smale. His efforts earned him the Fields Medal in 1958.

In the years 1959–60, following Marston Morse and Hassler Whitney, he began to turn his attention toward the theory of singularities of differentiable mappings. It is out of these mathematical endeavours that there would evolve his 'catastrophe theory'. Catastrophe theory seeks to provide a general qualitative explanation of the dynamics of sudden changes (discontinuities) in natural systems. It applies to physical systems (for example phase transitions) as well as to biological, psychological, social, and even linguistic or semiotic systems (cf. J. Petitot, *Les Catastrophes de la Parole*, Paris, 1985). Its qualitative status was a source of great controversy around 1975 and played an important role in furthering enquiry into epistemological issues (cf. *Logos et Théorie de Catastrophes*, ed. Petitot, Geneva, 1989).

René Thom was in fact the first to have shown that singularity theory and, more generally, the theory of bifurcations of nonlinear dynamical systems, could serve as a mathematical basis for a general theory of *morphogenesis*. Most specifically, he produced a theoretical elucidation of the processes of differentiation, organization, and regulation found in biological embryogenesis and organogenesis. It is well known that modern physics developed as a *quantitative* physics of forces excluding any *qualitative* physics of *forms* (this is the essence of the Galilean break with the Aristotelian tradition). The possibility of developing a mathematical theory of morphological structures and morphogenetic processes opens up the new possibility of a synthesis of post-Galilean physicalism and neo-Aristotelian hylomorphism.

It is also known that the Aristotelian legacy has been reinterpreted in numerous ways since the time of Kant, for example with *Naturphilosophie* and vitalism, or with Franz Brentano's psychology and Gestalt theory, or with Husserlian phenomenology and now with the cognitive sciences. For the first two, the morphological level of reality is the result of an ideal internal organizing principle acting in matter; for the second two, it is a perceptual construction; for Edmund Husserl it is the result of the noetico-noematic shaping of sensations; and for the cognitive scientists, it arises from the processing of external information by a formal calculus (a computation) operating on mental symbolic representations. It is clear that none of these reinterpretations succeeded in developing a theory of morphological, qualitative objectivity compatible with the physical theory of quantitative objectivity.

A morphological structuralism like that developed by Thom, in contrast, explains the link between the physics of substrates as modelled mathematically, and the qualitative structures of the perceptible world as these are apprehended by the senses and described linguistically. It opens onto what René Thom now calls a *semiophysics* and leads to a naturalist and realist approach to meaning. Contrary to the reigning nominalist world view, it leads to the granting of ontological content to the qualitative organization of the phenomenological world. Progress in mathematical physics hereby refashions the logical bond between λόγος and φύσις, a

bond which had to be broken in order that physics could take shape and develop, but which can now once more be set in place.

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JEAN PETITOT

Thomas Aquinas

Life, Works and Influence. Thomas Aquinas was born in a noble family at Roccasecca near Naples in 1224 or 1225, and educated at Monte Cassino and the University of Naples. In 1244 he joined the Dominicans. In 1245 he went to Paris, and in 1248 to Cologne, to study under Albert the Great, being ordained priest in 1250. In 1252 he returned to Paris to teach, becoming Master in Theology in 1256. In 1259 he returned to Italy. He had by this time already written, among other works, the *De ente et essentia*, a programmatic discussion of key Aristotelian concepts; a commentary on the *Sentences* of Peter Lombard (*c.* 1100–64), then the standard text in theology; a number of disputed questions, including one *On Truth*; and had begun the *Summa contra Gentiles*, a textbook for missionary work among Muslim intellectuals. In Rome in 1265 he began his greatest work, the *Summa Theologiae*, which was all but finished at his death. Around the same time he began the first commentaries on Aristotle to be composed in the West. They cover most of Aristotle's major works and continue to be of value today. In 1269 he returned to Paris. Here he defended his interpretation of Aristotle against both the more radical Averroist Aristotelians and the more conservative Augustinians. In 1272 he returned to Naples, where on 6 December 1273 his health broke down after a mystical experience. He never wrote any more. He died in Fossanova on 9 March 1274, after a fall when travelling to the Council of Lyons. He had been famous during his life for his sanctity and for his teaching. Though some propositions that he held were condemned by the bishop of Paris in 1277, and though he left no school behind him, his fame increased slowly over the years. He was canonized in 1323, after which the condemnation was revoked. In the 16th century many theological theses of his were incorporated into decrees of the Council of Trent, and in the 19th century he was put forward by the Pope as master and model of theologians. In the 20th century some philosophical theses of his were enjoined on Catholics by the Pope as safeguards of orthodoxy.

His Place in Philosophical Tradition. Aquinas was both an Augustinian theologian and an Aristotelian philosopher. (The index of a recent edition of the *Summa Theologiae* gives roughly the same numbers – about a thousand – for citations of Aristotle and Augustine.) He held, with Augustine, that true understanding could come only as a fruit of faith, and that believers would be able to interpret all human wisdom: the teachings of the philosophers could be either incorporated into this interpretation, or rejected. Aquinas's life work was to bring about a reconciliation and synthesis of the newly discovered works of Aristotle, incorporating as much of them as possible into the traditional understanding that had developed since Augustine. Sadly, in his own time this reconciliation was in general not accepted by either side of the dispute.

Analogy. Crucial in this reconciliation is the notion of analogy. This is developed from Aristotle's account of homonymy and Pseudo-Dionysius's (6th century) account of the ways in which human language can be used of God. Expressions need not be either univocal – signifying just one thing – or equivocal – signifying two or more entirely different things. They may be analogical: expressions which have different senses which are systematically related. Most of the principal terms of Aquinas's metaphysics 'existent', 'true', 'one and the same', 'same', 'acting', 'actuality', 'potentiality', and the

like – are analogical in one way or another. Analogy is used by Aquinas, for example, to reconcile Augustine with Aristotle on truth. For Aristotelians, truth is something that arises in the match of the human mind with the world: for Augustinians, 'truth' is another name for God. For Aquinas, the truth which is God is primary and fundamental in the order of existence or reality: but in our usage of the word 'truth', Aristotle's sense is prior. The same considerations apply to 'good', 'existent', etc.

Metaphysics. Most distinctive in his metaphysics is his treatment of the notion of actual existence (*esse*). This notion is related analogically to those of truth, goodness, identity, etc., and is itself a nest of analogical notions. He discusses, in order to put on one side, the notion of "existence in the sense of the true" (*esse ut verum*) – the notion of existence according to which everything that can be truly and affirmatively spoken of can be said to exist. His metaphysics is a study of the actually existent (*ens*). "Actually existent" is a general notion, of which 'living' is a species. Like Aristotle, he also leaves aside what is actually existent in a coincidental way (*ens per accidens*), to concentrate on the actually existent in its own right (*ens per se*), and within that, on substance. Readers familiar with ontology today should be careful to notice Aquinas's exclusive concern with the actually existent. For example, Aquinas's 'forms' are not to be identified with Gottlob Frege's 'concepts' (*Begriffe*), even though a form, like a concept, is signified by a general term in predicate position. Forms are only those concepts whose instantiations are actual existents in their own right – individual substances or accidents. His notion of 'essence', too, is different from that of contemporary authors – what is true of an individual in all possible worlds – not only in that he is interested in what is necessarily true of a substance only in so far as it is a member of its species, but also because for him 'essence' includes only actually existent properties. A negation like 'not being a square root' is not part of the essence of any animal. What chiefly marks out Aquinas's metaphysics from others of his own age also has to do with *esse*: it is his claim that God's essence and actual existence are identical, while in everything else there is a real distinction between essence and actual existence.

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C. F. J. MARTIN

Thomas of Erfurt. See: Copula; Modi Essendi

Thought

The English word 'thought' and its (alleged) synonyms in other languages do not have a standard philosophical use. Plato and Aristotle used νόησις and διάνοια for a certain kind of inherently cognitive consciousness with a distinctive object, namely, universals. René Descartes used *cogito* to apply to all of one's modes of consciousness. Kant held that thought (*Denken*) is cognition (*Erkenntnis*) by means of concepts (*Begriffe*). 'Thinking' is often used for what is more precisely called reasoning, and this is part (but only part) of the motivation for recent work (e.g. Jerry Fodor's) on whether thinking can be understood as analogous to the functioning of a computer.

Probably the most useful sense of the term is as the name of consciousness that is primarily conceptual and thus distinguishable from sense perception, imagination, and emotion, which, even if they necessarily involve concepts (a controversial view) are not primarily conceptual. This is the general sense in which H. H. Price (1899–1985) uses it in his classic work *Thinking and Experience*. Within it may be distinguished two specific senses.

The first expresses the Greek notion of thought as essentially the apprehension of universals. Whether there is thought in this sense is, of course, a controversial issue, but its importance to ontology is obvious. A

major consideration in discussions of the problem of universals is whether we are aware of such entities, and to avoid the everyday connotation of 'aware' that renders the question rather simplistic, we might well replace 'aware' in it with 'think'.

But the term 'thought', still used in the general sense I have recommended, also has a second specific sense, in which it is applied to certain familiar modes of consciousness of objects that are not universals. We may think of an individual object *in absentia*, i.e., when we do not perceive it or even when there is no such real object at all. In doing so we may employ mental images, physical representations, words, but the thinking does not *consist* in any of these, for we must also know what the image, representation, or word 'stands for', if it is to have a role in our thinking at all. Such knowing can be occurrent and is properly describable as thinking of the object imaged or represented or meant. This second sense of 'thought' is related to the first, since thinking of objects *in absentia*, unless confused with mere imagination, drawing, or talking, seems to presuppose the possession of relevant concepts, and perhaps concepts cannot be understood except in terms of universals. 'Thought', in the second sense, is also an essential aspect of recognition, which is arguably the most rudimentary kind of cognition. Recognition is not mere perception or imagination or verbal activity, even if it involves one or more of these. Although neither is it the same as *recollection* of a previously encountered object, it essentially involves thinking *in absentia* of such an object.

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PANAYOT BUTCHVAROV

Time. See: Space-Time

Time Flow, Temporal Passage

The picture of time as passing or flowing is extremely common. "Time, like an ever-rolling stream, bears all its sons away." But this picture, though one that most people would accept, has not stood up well to philosophical analysis. Most philosophers and scientists today would dismiss it as at best metaphorical, and deny that time passes or flows in any literal sense. Whether this is so, and what philosophical meaning, if any, can be attached to the notion of temporal becoming, are important metaphysical questions.

C. D. Broad (1887–1971) maintained that flow, or what he called "Absolute Becoming", was a

> rock-bottom peculiarity of time, distinguishing *temporal sequence* from all other instances of one-dimensional order, such as that of points on a line, numbers in order of magnitude, and so on.

Yet for most scientifically minded philosophers the concept of temporal passage has to do not with the real world, but with subjective consciousness. For Hermann Weyl (1885–1955),

> The objective world simply *is*, it does not *happen*. Only to the gaze of my consciousness, crawling upward along the life line of my body, does a section of this world come to life as a fleeting image in space which continuously changes in time.

Weyl's picturesque image derives from conceiving of the world as laid out in four-dimensional Minkowski space-time. To say, in the Minkowski world, that a poker *becomes hot*, is simply to say that the four-dimensional worm that represents the poker is cold at some temporal cross-sections and hot at others. In the Minkowski world, time does not flow.

Furthermore, in Minkowski space-time there is no role for the concepts of past, present, and future. What does it mean to say that an event is occurring 'now'? Only that a conscious being so experiences it, or so describes it. But this implies that in the Minkowski world there is not one present, but many. There is a 'now' for Cleopatra. There is a 'now' for us. There will, no doubt,

be 'nows' for our great-grandchildren. But where is *the* present? In Minkowski space-time there is no such thing.

Despite the lack of a 'present', many philosophers hold that temporally asymmetric processes such as entropy increase mark a distinction between the 'past' and 'future' ends of the Minkowski manifold. For Hans Reichenbach, entropy increase in thermodynamic 'branch systems', e.g. an ice-cube melting in a glass of water, gives time a *direction* if not a flow. But as Adolf Grünbaum shows, such processes do no more than create temporal *anisotropy*, not a unique direction; i.e., they serve to distinguish one direction of time from the other, but not to pick out *the* direction of time.

For Grünbaum, the flow and direction of time are *mind-dependent* features of the world in the sense that without conscious observers they do not exist. The same goes for the divisions of past, present, and future (J. M. E. McTaggart's A-series), though not for the B-series relations of earlier and later. In this, Grünbaum follows the thought of a 1915 article by Bertrand Russell:

> It is of the utmost importance not to confuse time-relations of subject and object with time-relations of object and object; in fact, many of the worst difficulties in the psychology and metaphysics of time have arisen from this confusion. It will be seen that past, present and future arise from time-relations of subject and object, while earlier and later arise from time-relations of object and object. In a world in which there was no experience there would be no past, present, or future, but there might well be earlier and later ("On the experience of time", *The Monist*, 212–33).

For Russell, the movement of events from the category of 'future', through 'present', to 'past', is an instance of what P. T. Geach has aptly named *Cambridge change* (*Truth, Love and Immortality*, 1979). An object O undergoes Cambridge change iff there are two propositions about O, differing only in that one mentions an earlier and the other a later time, and one is true, the other false. A poker which is cold at t_1 and hot at t_2 undergoes Cambridge change, but so does Aristotle each time someone today thinks of him, or even whether anyone thinks of him or not, for every day the date of his birth recedes further and further into the past. It seems obvious that the poker undergoes real change in addition to Cambridge change, while Aristotle does not, but the task of distinguishing between real and merely Cambridge change is not easy. At present Cambridge change, according to Geach, is the only clear, sharp, conception of change we have.

For the majority of scientifically minded philosophers, events undergo mere Cambridge change in time, whereas the domain of natural science is real change. Time flow, properly understood, is either a subjective illusion or a Lockean secondary quality, like colours and sounds. However, it is possible to construct a model of the real world in which time flow is objective. Instead of a single Minkowski manifold, imagine a branched tree-like structure, each branch of which is a four-dimensional space-time. The set of branches above each branch point is the set of physically possible futures relative to conditions obtaining at the branch point. Above the first branch point of the tree, one and only one of the branches will remain to become part of the trunk; the remaining 'unactualized' branches vanish. (See McCall, *A Model of the Universe*, 1991.) On such a model, time flow is represented by progressive branch attrition, and takes place independently of the existence of conscious observers.

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STORRS MCCALL

Time-Space. See: Space-Time

Topology

In 1872 Felix Klein (1849–1925) proposed that a geometry could be defined by the

transformation group that preserves its characteristic relations. A topological space is defined as a pair $<X, O>$ – where X is a set and O a family of subsets of X – which satisfies the following three conditions:

1. $\varnothing$ and X belong to O.
2. The union of every family of members of O belongs to O.
3. The intersection of any two members of O belongs to O.

The family is then a topology on the set X and the members of O are called open sets. Let $<X, O>$ and $<X', O'>$ be topological spaces. A mapping $f: X \rightarrow X'$ is said to be open if f maps open sets on to open sets; it is said to be continuous if, for every open set U of X', the set $\{x | f(x) \in U\}$ is an open set of X. If the codomain of f equals its range, and it is a one-to-one correspondence, f is said to be a bijective mapping. An open and continuous mapping is called a homeomorphism and, very briefly put, it is homeomorphisms which characterize topology.

Topological spaces proved to be particularly useful in algebraic logic and in the geometrical representation of physical phenomena. In the history of topology the question: 'What dimension does space have?' has played an important role, especially in linking geometrical with physical space.

When Leonhard Euler (1707–83) and Johann Benedikt Listing (1808–82) pointed out that a certain relation between the number of edges, vertices, and surfaces of a polyhedron remains fixed even when the polyhedron is projected on to a sphere, a step towards the notion of topological transformation was made. Indeed, Listing was the first to use the word 'topology'. Listing was a disciple of Carl Friedrich Gauss (1777–1855), who had given a general definition of curvature. Gauss's proof (1827) that there are properties of a curve which do not change even if it is moved or bent in any way – so long as it is not stretched or shrunk or torn – opened up a new abstract way of thinking which led him to search for "a higher domain of the general abstract theory of quantity, independent of spatial things, whose subject is the combination of quantities connected according to continuity" (Inaugural Dissertation, 1876).

In his work on least squares of 1850, Gauss employed the Kantian term *'Mannigfaltigkeit'* (manifold) to refer to n-dimensional spaces. His follower Georg Friedrich Bernhard Riemann (1826–66) made a profound generalization of this term. In his lecture "*Über die Hypothesen, welche der Geometrie zugrunde liegen*" (1854), Riemann deals with three themes: the general concept of an n-fold quantity, the foundations of non-Euclidean geometry, and the relationship between geometrical and physical space. Riemann now uses the term 'manifold' to signify a general concept of quantity. A manifold, in Riemann's sense, approximates to our contemporary notion of topological space, although in trying to define it he struggled with philosophical terms such as 'genus' and 'specifications of a genus' in a rather obscure manner. We can understand Riemann's manifold as the set of specifications of a genus. He speaks of discrete and continuous manifolds and develops methods for producing n-dimensional continuous manifolds and for determining points in such manifolds by sets of quantities, i.e. real number coordinates. Riemann's construction method is analogous to the idea that a continuous moving line produces a surface. If we suppose, for example, that a 1-dimensional manifold passes over, by means of a 'continuous transition' (a forwards and backwards motion), into a series of such manifolds in point-to-point correspondence, then we obtain a 2-dimensional manifold. In general we can continue the process to give an n-dimensional manifold.

After Riemann some mathematicians persisted in following a rather intuitive geometrical idea; others turned to a more abstract point of view. We could say that these two approaches became reunited in the work of Jules Henri Poincaré (1854–1912) and Luitzen Egbertus Jan Brouwer (1881–1966), thanks to the generalizations of Sophus Lie (1842–99) and Felix Klein.

The Abstract View. In 1817 Bernard Bolzano and in 1872 Karl Weierstrass (1815–97) developed a rigorous formal treatment of analysis and continuity, introducing the

notions of 'interior' (a subset I is called the interior of an open set A if it is the greatest open subset of an open set A) and 'neighbourhood' (a set U is a neighbourhood of a point p, if U is open and p belongs to U). The dimension of a manifold was hereby defined as the number of its coordinates. Georg Cantor criticized in 1874 the coordinate theory of dimension, showing that a line segment could be put in bijective correspondence with a square. In 1877 Richard Dedekind (1831–1916) conjectured that the coordinate theory of dimension could be rescued given the additional constraint that the correspondence be continuous. Dimension was by this means treated as a topological invariant. Dedekind's conjecture was proved by Brouwer in 1911.

The Geometrical View and its Generalizations. Hermann von Helmholtz (1821–94) attempted in 1878 to prove an assumption made by Bernhard Riemann to the effect that only on n-dimensional manifolds with a constant curvature could figures be rotated without expanding or contracting. Thus he understood Riemann's 'continuous transition' in a quasi-operational way, and connected it to the notions of congruence, rigid bodies, and free mobility. Inspired by the results of Klein, Lie went on in 1886 to give an abstract version of the Helmholtz-Riemann problem. Using his own theory of continuous groups, he represented the movements of a rigid body in space by means of a group of transformations. Poincaré then introduced the word 'homeomorphism' in 1895. In a rather intuitive way, he defines dimension-number recursively, exploiting Dedekind's idea of a cut on a continuum. Brouwer, the founder of intuitionism, showed in 1911 that Poincaré's definition is not always applicable and gave a proof of the topological invariance of dimensionality using the idea of boundary (the boundary of the set A is the intersection of its complement and the complement of its interior). Finally all of these ideas crystallized in Felix Hausdorff's (1853–1928) formalization of topological spaces in 1914.

More recently Helena Rasiowa and Roman Sikorski provided a method to identify a Brouwerian algebra (intuitionistic algebra) using topological spaces and applied this idea to first-order logic. In 1956 Everett W. Beth (1908–64) was the first to use a topological space to give a semantics for intuitionistic logic.

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Topos Theory

Topos theory generalizes set-theoretic reasoning creatively. This is of significance for mathematics because it creates a logical space for mathematical entities which cannot be directly represented and reasoned about set-theoretically. Likewise, since set-theoretic reasoning has been ubiquitous in metaphysics, topos theory creates the possibility of reasoning well about, and therefore of admitting as real, entities incapable of *direct* set-theoretic representation.

Sets are powerful mimics. Most mathematical structures can be imitated by sets – they can be rather directly represented by typically very complex sets in 'the' set-theoretic universe characterized by, say, Zermelo-Fraenkel set theory. The usual concept of that universe is of sets transfinitely built up from the empty set, $\emptyset$. For example, the natural numbers 0, 1, 2, 3, ... can be represented by $\emptyset$, $\{\emptyset\}$, $\{\{\emptyset\}\}$, $\{\{\{\emptyset\}\}\}$, ... (If $a, b, c, \ldots$ are objects, then $\{a, b, c, \ldots\}$ indicates the set of those objects.) The set of natural numbers is then the infinite set $\omega = \{\emptyset, \{\emptyset\}, \{\{\emptyset\}\}, \{\{\{\emptyset\}\}\}, \ldots\}$.

Of course, that is only a start on representing the structure of the natural numbers. Indeed, $\{\emptyset, \{\emptyset\}, \{\{\emptyset\}\}, \{\{\{\emptyset\}\}\}, \ldots\}$ represents the natural numbers most incompletely. For example, if $\in$ indicates the relation of sets to their members, then we have $\{\{\emptyset\}\} \in \{\{\{\emptyset\}\}\}$. The set representation of

the number 2 is an element of the set representation of the number 3, but, of course, the number 2 is not an element of the number 3. Thus we must be more elaborate in our set-representation of the natural numbers in order to exclude such incidental properties induced by our representing the numbers by sets built up from the null set. We must not only give a representation of each of the natural numbers, but we must also give a set-representation of the relations obtaining among the natural numbers, the numerical relations. For example, a fundamental numerical relation is the functional relation of one number being an immediate successor of another. We must include a set that represents the successor function. Functions can be represented as sets of ordered pairs $<a,b>$. The successor function can be represented by a set $\{<0,1>, <1,2>, <2,3>, \ldots\}$, where 0, 1, 2, ... are replaced by their set representations. But we must also replace '$<a,b>$' by a set representation, e.g., $\{a,\{a,b\}\}$. Properties of the natural numbers which must be added to our set representation of the natural numbers can be represented by sets consisting of the set representations of exactly those natural numbers having those properties. Thus primeness is represented by the set $\{2, 3, 5, 7, \ldots\}$, where 2, 3, ... are replaced by their set representations. (Technically the representations are achieved by means of explicit definitions in the language of set theory together with existence proofs that the set-structures picked out by the definition – such as that representing the successor function – exist.)

From this brief discussion it is clear that one must already know a great deal about a mathematical structure before one can come up with a set representation of it. Why then bother with set representations at all? On the assumption that almost all mathematical structures generally can be given adequate set representations, one can then reason about almost all of them set-theoretically. This gives something like a canonical logic for much of mathematics and it also thereby induces a kind of unity among all mathematical structures. This uniformity of reasoning provides grounds for comparing and relating what in standard mathematical practice might be taken to be two quite different structures, as though constructing a set of ordered pairs, first members coming from the elements of one structure, second members coming from the elements of the structure being compared with the first. Then one can reason set-theoretically about, say, structural similarities between the structures. But also set-theoretic construction is a powerful resource for building new things out of old things, such as building the set of ordered pairs of members of two sets, or the set of all functions from one set into itself or into another set.

There are, however, some limitations to set-theoretic representation and therefore to set-theoretic reasoning about mathematical structures. Conspicuous among them are two. Sets have the trait of being definitely extended. This means that for any object, either it is a member of a set or it is not. There is no room here for the *direct* representations of other than exact or more fluid relations and properties. Furthermore, there is as it were nothing more to a set than its elements or members, so that we have the principle of extensionality: a set b and a set c have the same members if and only if $b = c$. When we come to representing a mathematical structure, we choose – as we have illustrated – a set S to represent the elements of the structure and then further sets to represent the relations among the elements of the structure. Those relation-representing sets are limited to those definable in terms of $\in$. Another way of saying this is that those relation-representing sets are extensional (because governed by the principle of extensionality), not intensional. But it might be that there are quite cogent mathematical entities and relations on them that cannot be given in terms of a membership relation governed by extensionality. There might be entities which are like sets in that they have something quite analogous to the set-membership relation on them, but which are such that b and c can have the same 'members' and not be identical. Topos theory is a rich fund of 'set theories' which go beyond both these limitations of standard set theory.

Set-theoretic reasoning has been all but ubiquitous in both mathematics and in recent

analytic metaphysics. For example, in the latter case, properties, relations, possible worlds are typically assumed to be representable as set structures. But the question naturally arises in metaphysics, *Are indeed all entities which can be reasoned about capable of being reasoned about set-theoretically, or are there more or other things that can be so reasoned about?* Both from a mathematical and a metaphysical point of view the question arises, *Can set-theoretic reasoning be generalized in a way preserving principal virtues of set-theoretic reasoning but so that entities could be represented, and hence reasoned about, that could not be set-theoretically represented in any direct way?* Topos theory enables us to answer 'yes' to the second question and 'no' to the first.

What are the virtues of set-theoretic thinking that we would like to see preserved in any generalization? Large among the virtues are the powers of constructing new entities from old that are available in set theory. There are other nice traits, having to do with the *interrelatedness* of possible constructions, in which set theory is especially rich. Interrelatedness is extremely important for richness, depth, and simplicity of structure and reasoning. For example, in geometry, without interrelations among points and lines of the sort that two points determine one, and only one, line, geometry as a mathematical subject would fall apart into near chaos (imagine what would happen if no particular number of points determined a line). Topos theory more or less preserves the kinds of constructions that are available in set theory as well as important kinds of interrelatedness while opening up the possibility of relationships (such as those of an inexact or intensional kind) that cannot be directly represented by set constructions.

Topos theory is built up within mathematical category theory. Categories consist of:

1. a domain of things called objects of the category,
2. a domain of things called arrows, and
3. an operation of composition among arrows,

with the following laws satisfied: each arrow f has associated with it objects a, b, where a is its domain and b its codomain, and the arrow goes from a to b. Two arrows f, g compose if and only if the domain of f matches the codomain of g, and then their composition, fg, is an arrow of the category. For any object b there is an identity arrow with domain and codomain b. Composition of arrows is associative.

The arrow is a generalization of the idea of a function between domains as sets of objects, composition corresponding to functional composition. But a categorial structure can be anything that satisfies the requirements. For example, we could let the objects be the natural numbers and the arrows the less-than relations obtaining between pairs of numbers (the ordered pairs such that the first is less than the second).

It turns out that analogues of set-constructions can be defined in terms of arrows of categories, although all constructions need not exist in all categories (Goldblatt 1984, Chapter 3). This is done by finding a relational characterization of the set construction and then translating it into arrows and objects.

Thus, in set theory, the Cartesian product $A \times B$ construction (the set of ordered pairs the first members of which come from A, the second members coming from B), has two relational or structural traits:

1. there are projection functions P_A, P_B from $A \times B$ into A and B, and
2. $A \times B$ is the least set with that property in that all other sets with that property can – in a sufficiently strong sense – be embedded in $A \times B$.

Here the reconstruction in arrows proceeds, roughly, as follows: the product (in a category) of a and b is an object c for which there exist arrows, both with domain c, one with codomain a, the other with codomain b, and c is the minimal object with this property (i.e., for all other objects d with that property there exists an arrow from d to c preserving that property).

The idea of an element or member of an object – mimicking the member-set structure – is obtained in the following way. The category is supposed to have a 'terminal

object', an object 1 such that there is one, and only one, arrow from any object in the category to 1 (in the category which is the usual universe of sets, any singleton set {a} would be a terminal object). Then, for any object *c* of a category with a terminal object 1, the 'elements' or 'members' of *c* are all of the arrows from 1 to *c*.

A topos is now – very roughly speaking, to give the idea – a category with a terminal object (so the objects can look like they have elements) and which has certain minimality relations among its objects sufficient to introduce correlates of the familiar set-theoretic constructions (e.g., Cartesian product, exponentiation, subset). (The minimality relations also ensure that sort of richness of interconnectedness among objects we referred to above.) In this sense topoi are good generalizations of set theory. But, happily, one has topoi deviating in some ways, even wildly, from standard set theory. Thus, it is not the case in all topoi that two objects (correlates of sets) are identical if and only if they have the same elements (that is, roughly, the same arrows from the terminal object into them).

Aristotle had once asked if there were indivisible lines, as would be fluid rather than discrete continua. Classical real number continua are ultimately discrete and made up of definite 'points', the real numbers. It is by virtue of this that they are divisible. Thus, for example, the continuum of points between 0 and 1 can be divided into those before 3/4 and those including and following 3/4. But there are topoi in which it is possible to directly imitate the real numbers but in which they form linear continua which are not at all divisible: even though 3/4 is well defined, 'the numbers preceding 3/4' is not well defined. (The general property causing this circumstance is that *all functions* on the continua in these topoi are continuous. If 3/4 divided one of those continua, then we could define a function that sent all numbers before 3/4 to 0 and 3/4 and all numbers greater than 3/4 to 1; but that would be a discontinuous function.) Imagine something moving along a straight path, the path regarded as 1 unit in length. Then, although 3/4 is different from, and greater than, say, 2999999999/4000000000 (so that there is some considerable mathematical integrity to the continuum), 3/4 is not this definitely situated with respect to all 'points'. This has the consequence that a moving object is never (even instantaneously) exactly *at* a particular point in the sense of being in a definite position with respect to all other points. Thus Zeno's paradoxes do not become an issue for such continua that are not divisible at all (not even, as in Aristotle, potentially)! Perhaps such continua give a better representation to our sense of motion as generally something fluidic.

Let this stand as an indication of the sense in which topos theory, as a theory of set theories (Bell 1988, Chapter 8), might enrich our metaphysical imagination. From another direction topos theory incorporates theories of 'variable sets' which are of powerful utility in reasoning about dynamic and fuzzy systems (such as the structure of a commercial corporation) and in ways more effective and logic-like than now traditional fuzzy-set theory (Negoita 1980). Such variable-set theories, like all topoi (and so including classical set theory) have an intuitionistic logic, giving an as it were absolute significance to this (classical logic is, of course, just a special case of intuitionistic logic). This suggests that intuitionistic or constructive logic may be the logic of the future, a future of more creative and powerful metaphysics made possible by topos theory.

For the metaphysician wanting to acquire technical competence in topos theory, the works of Bell and Goldblatt listed below are the most useful. A serious obstacle to acquiring such competence is that of learning enough mathematical category theory. Here Goldblatt is most helpful. Goldblatt also enables one to see clearly the relationships between topos theory, set theory, classical logic, and intuitionistic logic. But, in the end, Bell presents a far more useful characterization of topoi, although the text fails to give as good a feel for the concrete aspects of the subject as does Goldblatt.

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ROBERT S. TRAGESSER

Transcendence

The term 'transcendence' comes from the Latin '*transcendere*', meaning to transcend, to go beyond some point or limit. In philosophical language, this word can have a static or a dynamic meaning. In its static (ontological) sense, it means 'to lie beyond some fundamental limits'. In this sense some philosophers designated as 'transcendentals' or *transcendentia* being itself and those properties of being which lie beyond all categorial limits and restrictions. (In an analogous sense, mathematicians speak of 'transcendent equations' and 'transcendental numbers' and indeed any infinity in number or division transcends all finite numbers, measures, or divisions.)

A similar ontological lying beyond a limit is meant when one speaks of the transcendence of an infinity with respect to some finite measure, or of the transcendence of the person with respect to other beings.

Philosophers spoke likewise of the infinite transcendence of God who exists beyond all limits of this world and who is infinitely greater than all creatures. Anselm of Canterbury expresses this transcendence when he refers to God as "that greater than which nothing can be conceived". This name expresses absolute and unsurpassable infinity of perfection which is the complete and absolute transcendence, in the static, ontological sense of the term.

From this there follows, as Anselm argues in *Proslogion* xv, also a certain epistemological transcendence in that the absolute being is also "greater than can be conceived". This does not imply transcendence in the sense of that which is completely unknowable (as agnosticism, for example, implies) but rather something the apprehended attributes of which we cannot fully comprehend.

Kant also introduces a similar concept of transcendence when he treats of the "transcendental ideas of reason"; he, however, applies the term in two different senses as referring to that which lies beyond the limits of the objects of experience and as that which exists independently of the subject in the sphere of the thing in itself. In the first sense, he ascribes transcendence to his 'transcendental ideas' of God, world, and soul because these extend the categorial forms beyond all limits of experience. Kant speaks also of a 'transcendent use' of the transcendental ideas, however, when they are not considered as products of human reason but as existing in themselves. Thus he calls the thing in itself transcendent because it exists beyond the limits of the subject – precisely by being 'in itself'.

The 'transcendent' in Kant, then, is that which really exists independently of the subject, which he posits and yet regards as unknowable. The 'transcendental' in Kant – on the contrary – is made of those structures in the subject and of those ideas which the subject inescapably projects into the world but which do not correspond to any being in itself, i.e., independent of constitution through the subject. A 'transcendental illusion' occurs, according to Kant, when the subjective transcendental ideas are thought to be transcendent realities.

Kant explicitly denies the transcendent existence of God, world, and of the soul – insisting that we know them only as transcendental ideas. Thus Kant denies the transcendence of God, soul, and world in the sense of their lying beyond all objects of human reason. So much about Kant's notion of transcendence.

In another sense, immortality or the life after death is a transcendent life because it is not experienced by us now (lies beyond the limits of our experience) and also because its reality implies that human existence is not enclosed within the limits of our temporal and earthly life.

In all of these different senses, however, 'transcendence' means an objective-lying-

beyond-the-limits of something: of the finite, of knowledge, of the subject, of that which falls within the power of knowledge, and so on.

In its second, dynamic sense, to transcend means 'actively to go beyond some limits'. In this sense, Edmund Husserl sees a certain 'immanent transcendence' in the intentional act in so far as this act is related to some object *of which* we have consciousness. This object is not part of our consciousness and is in this sense transcendent to it. Psychologism as Husserl criticizes it in his *Logical Investigations* (1900/1) fails to recognize this, by making objects of intentional acts immanent contents of consciousness. Other authors distinguish the transcendence which is achieved in all intentional acts (and which we find also in cases of illusion or error) from the truly transcending transcendence which is achieved in acts embodying knowledge. The knowing subject, in his acts, knows something or some state of affairs as it is in itself, independently of the subject. He thereby goes beyond the limits of his own experience and of his own subjectivity; he likewise goes beyond 'purely and merely intentional objects'. To transcend in this sense means to partake consciously in that which is beyond the subject. Corresponding to each sense of 'thing in itself' one could then speak of different meanings and degrees of cognitive transcendence (Seifert 1972, 1989).

Max Scheler (1874–1928), Martin Heidegger in *Vom Wesen des Grundes* (1929), Josef Pieper (b. 1904), and others speak of transcendence only when the subject is related to the world as a whole, or to being as such. The metaphysician *qua* metaphysician would then transcend both himself and partial aspects of the world.

In ethics and ontology of the person, the active sense of transcendence can refer to what G. E. Moore in *Principia Ethica* calls the appropriateness of emotions and to what Dietrich von Hildebrand calls *value response* – a conforming of our will or affections to the good in accordance with its value and the value-rank it possesses. In this way, a hedonistic or eudaemonistic attitude centring on one's own pleasure or self-fulfilment, and regarding the other person as a mere means towards pleasure or happiness, would be immanentistic, while a value-responding esteem or love which takes the other person seriously in himself and for his sake in virtue of his inherent preciousness, or 'as an end in himself' (Kant, Karol Wojtyła), would involve transcendence. If the person embodies being in its highest form, love of another person for his or her sake involves transcendence in its highest ontological-ethical form.

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JOSEF A. SEIFERT

Transcendental

The expression 'transcendental' is derived from the Latin '*transcendens*', which is the present tense active participle of the verb '*transcendere*': to surpass, to exceed. Etymologically closer to this origin is the metaphysical predicate 'transcendent': surpassing, exceeding (everything of a given kind).

There are two main meanings of the term:

1. An older one, which has been immediately inferred from 'transcendent' and which is used in commentary on scholastic philosophy;
2. a newer one, introduced by Kant rather in opposition to '*transcendens*'. The whole realm of transcendental philosophy is to be subsumed under this second meaning.

Ad 1. The medieval origin of 'transcendental' is somewhat in the dark. The *Thomas-Lexikon* (2nd ed., 1985) has the substantive plural '*Transcendentales*' under the headword '*transcendens*', and quotes passages which are meant to illustrate its use. In fact, however, one finds that it is only the plural '*transcendentia*' that is really being meant when commentators talk about '*transcendentalia*', the source of which is also unclear.

Wherever earlier we find the plural '*transcendentia*' or flexions thereof, e.g. in Thomas Aquinas or John Duns Scotus, these authors use the term to refer to ontological predicates which are transcendent in the sense that they surpass all divisions of being according to genera and species. The *Transcendentia* exceed also the structuring of being in terms of the Aristotelian categories. No genus, and *a fortiori* no species, is coextensive with the whole universe of being, but the *transcendentia* are. In "Quaestiones disputatae de veritate" (1256/59) Aquinas distinguishes five such transcendent predicates: thing (*res*), something (*aliquid*), one (*unum*), true (*verum*), and good (*bonum*). He argues that these apply to every being. Thus, in modern terms, the transcendentals coincide extensionally, yet they differ in intension.

It is more difficult to see why the *transcendentia* should exceed the categories too, since, in some sense, these apply to every entity as well. However, the Aristotelian categories define questions, and they apply to everything in the sense that these questions can be meaningfully asked with respect to any being, e.g. the question 'what is it?', corresponding to substance (cf. *Top.* I, 9). Yet, if asked with respect to, say, Socrates, the answer would be 'man', thus subsuming Socrates under this predicate, which of course, is not coextensive with the predicate *entity*. The *transcendentia* thus exceed all those predicates which yield an answer to the question 'Whát is it?' (a question that is everywhere significantly addressed to a thing). This is very nearly a necessary condition for such predicates' being substantial, and the situation with regard to the other nine categories is analogous.

John Duns Scotus enriches this class of transcendentals by giving a list of complete disjunctive attributes such as 'finite–infinite' and 'contingent–necessary', all being composed by a predicate of less perfection with its contradictory perfect quality. No component of these disjunctions is coextensive with being (whereas the disjunctions taken as a whole of course are – for logical reasons). However, if 'P' denotes some perfect quality and '$\neg P$' its imperfect contradictory, Scotus has a law to the effect that

$$\exists x \neg Px \supset \exists x Px$$

(if the less perfect quality is realized in some being, then its perfect counterpart is as well, cf. *Ordinatio* I, 39). While the disjunction '$P \vee \neg P$' would be a transcendental in the sense developed so far, this law itself is 'transcendental' only in the very loose sense that it somehow concerns the whole realm of being. In addition, Scotus claims that the components of his disjunctions are transcendental, since they have no genus *above* them, this being another meaning of the term.

Ad 2. Though coextensive with being, the scholastic transcendent attributes are none the less first-order predicates in the sense of modern logic. Kant, who gave the term 'transcendental' a new meaning, criticized this approach in §12 of his *Critique of Pure Reason* (1781). At first, Kant states that to apply each such predicate to a thing amounts to a tautology, and this is in fact nearly true with respect to '*unum*', where one would have: every entity is one (entity). The adequate usage of a transcendental is, Kant continues, rather with respect to *concepts* of things. Thus with respect to '*unum*', it is to state that a concept always represents something which is one and the same against the multiplicity of things comprised under it.

For Kant, then, the scholastic *transcendentia* have to be constructed as second-order predicates, in a way surpassing our first-order knowledge.

Positively, the term 'transcendental' acquires with Kant an epistemological meaning, designating the quality of a certain type of knowledge. Typically, to have transcendental knowledge is to know the difference between *a priori* and *empirical* truths,

especially with respect to science (cf. A 56/B 80). In the sense of modern logic and methodology, the term thus becomes not only a predicator of a meta-language, but even a substantial concept of the metatheory of knowledge.

In the *Critique of Pure Reason* Kant presents several transcendental disciplines, each exemplifying transcendental knowledge in this sense. The most important of these is the partition of the 'Transzendentale Elementarlehre' into 'Transzendentale Ästhetik' and 'Transzendentale Logik'. The theories developed under these headings use a type of reasoning which has more recently been called 'transcendental argument' (Strawson 1959). This use of 'transcendental' enriches the term's meaning. A typical conclusion of a transcendental argument is Kant's claim that "all multiplicities within a given intuition necessarily stand under categories" (B 143). This necessity claim is *eo ipso* an aprioricity claim and hence a transcendental thesis. What makes the respective argument transcendental is the fact that it itself involves an *a priori* statement, i.e. the theorem that the possibility of objective knowledge necessarily presupposes the application of the categories. The logical structure of a transcendental argument of this type would be:

(*a priori* α & *a priori* (possible $\alpha \supset \beta$) $\supset$ *a priori* β)

Another type of transcendental argument involves a stronger sort of relation of being-presupposed-by-a-proposition. E.g., to be semantically meaningful is an *a priori* condition for the truth as well as for the falsehood of any sentence. Hence from the fact that the sentence p is used to make a statement having a definite truth-value we can transcendentally argue to the thesis that p is semantically meaningful. The logical form of this argument would be:

(*a priori* ($\alpha \supset \beta$) & *a priori* ($\neg\alpha \supset \beta$) $\supset$ *a priori* β)

Transcendental arguments of a similar type have been used to justify ultimate moral principles (Griffiths 1957).

Since Kant, then, a transcendental X is above all something which refers to human reasoning about objects and which concerns the conditions of possible theorizing; the scholastic *transcendentia*, on the other hand, refer to the objects themselves. The most prominent post-Kantian works of such transcendental philosophy, works which use the term within their very titles, are F. W. J. Schelling's *System des transzendentalen Idealismus* (1800) and Edmund Husserl's "Formale und transzendentale Logik" (1929). For transcendental reasoning in Husserl's philosophy, see also his "Ideen zu einer reinen Phänomenologie und phänomenologischen Philosophie" (1913), which presents a transcendental phenomenology.

In "Sein und Zeit" (1927) Martin Heidegger has as the object of transcendental knowledge being itself, which is transcendent with respect to all entities in the sense of a condition which makes them possible. Here the transcendent, with respect to the transcendental, plays the role which for Kant is played by the *a priori*: "Phenomenological truth (disclosedness of being) is *veritas transcendentalis*" (*Sein und Zeit*, §7).

Ludwig Wittgenstein uses the term 'transcendental' twice in his *Tractatus Logico-Philosophicus* (1921). According to him, logic and ethics are 'transcendental' (6.13 and 6.421). Wittgenstein holds this view with respect to ethics because its object – value – is not within the world, hence value and the corresponding ethical reasoning are both '*transcendens*' in the original sense of the Latin participle. Logic, on the other hand, is for Wittgenstein concerned with what can be said within language; thus it is just the linguistic analogue of Kant's 'transcendental logic'.

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RAINER STUHLMANN-LAEISZ

Transcendentals and Pure Perfections

Under 'transcendentals', the medievals understood all properties and principles of being which transcend the limitations of the categories or most universal genera of beings. Being itself is thus transcendental and so also are other properties and principles which characterize all beings. In contradistinction to Kant's subjectivization of the transcendental as a matter of the subjective conditions of experience and of objects of experience, the medieval notion of the transcendentals is part of an objectivist ontology.

Medieval lists of the transcendental faces or aspects of being include up to seven:

1. *Ens (essentia, esse)* – or *being* itself.
2. *Res* (or content, considered as essence), reflecting the thesis – defended by Thomas Aquinas in *De Veritate* – that essence (quiddity) is a mark of everything that is. This is called into question by Etienne Gilson when he regards essence as restricted to finite beings.
3. *Unum* (one) or the inner unity and undividedness of everything that is.
4. *Aliquid*. Each being is something, neither nothing nor something else; it is identical with itself.
5. *Verum* (true). Every being possesses a certain ontological intelligibility, an openness to the intellect, and this is the source of the truth of concepts and judgements.
6. *Bonum* (the good), the value or positive importance of all being. Thomas identified this property of being with the *appetibile* and thought it to be relational, dependent on, and essentially ordained to strivings (*appetitus*). John Duns Scotus (and Dietrich von Hildebrand), on the other hand, saw the good as the *in se* importance of beings and as belonging also to things in themselves.
7. *Pulchrum* (the beautiful) which is the splendour of form and the radiance of being and of the good.

Some philosophers reduced the transcendentals to three: being, truth, and goodness; others attempted other definitions and restrictions. Duns Scotus refined and deepened the concept of the transcendentals by not reducing them to properties which are common to all things but by interpreting them as all properties which are free from any limitation to a finite being or category. He distinguishes four classes of transcendentals:

1. Being itself.
2. The properties which are coextensive with being.
3. Disjunctive transcendentals (for example: each being is either finite or infinite).
4. Pure perfections, i.e., attributes which are such that to possess them is absolutely better than to possess anything incompatible with them.

This last group includes many attributes which do not fall into the preceding groups; at the same time, the character of 'pure perfection' constitutes the deepest essence and common trait of all transcendentals. For Scotus understands transcendentals as all those attributes which transcend all categorical limitations and therefore can be in God. For all perfections the possession of which is absolutely speaking better than the non-possession are perfectly embodied in God and free of categorial limitations. Thus the deepest essence and the common feature of all transcendentals becomes their character of being pure perfections. For all transcendentals, particularly those in the first and second classes, are also pure perfections; but besides being pure perfections, they are also traits common to all beings, which is not true of all pure perfections. There are other transcendentals which are found in some finite beings only (life, wisdom) as well as in God. Finally, all exclusively divine attributes are pure perfections.

The question as to whether there are 'pure perfections' is without any doubt a key prob-

lem of metaphysics. It was first raised by the pre-Socratic Xenophanes (*c.* 570–*c.* 480 BC), who posed the question whether it was legitimate for the Greeks to ascribe to the gods morally evil and such all-too-human qualities as colour of skin, human voice, human body – of which he excludes that they can ever justly be so attributed – from unity, spirit, knowledge, power, etc. which he himself ascribes to God. This distinction had its effects throughout the history of philosophy, but only in the 11th century – in the work of Anselm of Canterbury – was it brought to explicit philosophical awareness (*Monologion*, 15). Anselm distinguishes clearly between such properties which – because of their inherent limitations – it is only sometimes and in certain respects better to possess than not to possess; and other properties which it is always and in each being (*in quolibet*) better to possess than not to possess. This presupposes an insight into the inseparable link between certain qualities and their limitations, while other qualities can be known to be 'pure' goods, in absence of any inherent limitation. As an example of 'mixed perfections' Anselm refers to gold, which is better than other metals but excludes higher perfections such as spirit, man, etc. Pure perfections are such things as being, life, beauty, goodness, knowledge, and wisdom. To possess any of these is absolutely and in every case better than not to possess them.

Another important epistemological point regarding the metaphysics of pure perfections was made by Thomas Aquinas, who said that we can know that these perfections are without inherent limit and therefore that that which is signified by the names of being, goodness, etc. is indeed unlimited – even though our mode of understanding and signifying them is limited.

The most important step in the elaboration of the theory of pure perfections was achieved by Duns Scotus in the 14th century (*Quaestiones Quodlibetales* q. 1; q. 5; *T. Oxon.* 1 d. 8, q. 2; *Ordinatio* 1 d, q. 3). Scotus showed that Anselm's characterization in terms of their possession being always better than their non-possession is insufficiently clear. For if non-possession refers to the pure and simple absence of a pure perfection, it is true also of mixed perfections that it is better, for example, to be gold than not to be gold (by being a lesser metal or by ceasing altogether to be). So what is characteristic of pure perfections is rather that there can be no positive quality which is incompatible with them. There can be no positive reason why the non-possession of a pure perfection could be preferable to its possession; in each case of a mixed perfection, however, we can find positive perfections incompatible with it.

A further significant contribution of Scotus regards the '*in quolibet*' (in everything) feature which Anselm uses. Scotus says that this term implies a subject of any nature, and argues that it is false that the possession of a pure perfection is better than its non-possession for a subject of any nature. For a dog it is not better to possess the pure perfection of wisdom – because it would cease to be a dog if it were wise. Thus we should say *in cuilibet* instead, meaning that it would be better for any *subject* to possess a given pure perfection X (even if this meant a change of nature in the event that this nature were incompatible with possessing X). Thus Scotus arrives at a definition of pure perfections which is even deeper in its implications than he realizes: "*perfectio simpliciter est, quae est simpliciter et absolute melius quocumque incompossibile*" (a pure perfection is one which is simply and absolutely better than anything incompatible with it). Seifert (1989) attempts to show that also certain limited subjects, not only their natures, as Scotus believed, can be incompatible with some pure perfections.

What, then, is the nature of pure perfections?

1. The first mark and core of pure perfections is their being absolutely speaking good, with all the necessary clarifications of this mark proposed by Scotus and others. Possibly Scotus's greatest contribution to the issue at hand lies in his elaboration of evidence and proof regarding several further essentially necessary marks of pure perfections.
2. They are all mutually compatible, which can be demonstrated from the first mark: for if A and B were pure perfections but incompatible with each

other, it would be absolutely better and at the same time not better to possess the given pure perfection *A* or *B*. It would be better to possess *A* because of its character of pure perfection, and better not to possess it because it would contradict *B* which is a pure perfection, and therefore absolutely better to possess.

3. Unlike mixed perfections which, being limited by their essence, necessarily exclude infinity – they all admit of infinity; indeed they are only fully themselves when they are absolutely infinite. Any finite being is not fully being, any limited justice not fully justice, etc. (Seifert 1989).
4. They are all irreducibly simple (*simpliciter simplex*, indefinable).

Scotus adds:

5. That they must all be communicable to more than one subject or person.

In this light, the character of metaphysics as a science of not only limited spheres of being but of being *qua* being, and the possibility of a metaphysics of God and of the transcendence of knowledge beyond the limited world, are inseparably interwoven and connected with what could be called *the* question of metaphysics: are there pure perfections and can we know them?

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JOSEF A. SEIFERT

Trendelenburg, Friedrich Adolf

Friedrich Adolf Trendelenburg (1802–72) studied in Kiel with Karl Leonhard Reinhold (1757–1823), in Leipzig and in Berlin, where he chose to follow Friedrich Schleiermacher (1768–1834) rather than Hegel. After teaching privately for some time, he became professor in Berlin in 1833, where he was also invited to join the Prussian Academy of Sciences. His writings include numerous historiographical works, amongst which are outstanding pieces on Aristotle and the history of Aristotelianism: the dissertation *Platonis de ideis et numeris doctrina ex Aristotele illustrata* (1826), *De Aristotelis categoriis* (1833), *Elementa logices Aristoteleae* (1836), *Geschichte der Kategorienlehre* (1846), and the critical edition of *De Anima* (1833). But Trendelenburg's most important speculative works are the *Logische Untersuchungen* (1840, third edition 1870), which is his major work, and *Das Naturrecht auf dem Grunde der Ethik* (1860).

Trendelenburg was resolved to provide a foundation and unitary structure to all systematic knowledge. He took Aristotle (and also Kant) as a point of reference and in opposition to the philosophy of his time – in particular to Johann Friedrich Herbart and Hegel – put forward an *organic conception of the world* (divided into a logic and a metaphysics and grounded upon the idea of finality). Opposing the conception of logic of Herbart and his school, Trendelenburg criticized their separation of form and content, showing how even the most abstract laws of logic can be thought only by reference to objects. He rejected the supposed deduction of being from the self-movement of pure thought in Hegel's dialectic. Looking to Aristotle and Kant (and especially to the Kantian conception of *Realrepugnanz*), he believed that the self-explication of pure thought at the beginning of Hegel's logic in fact presupposes sensible intuition and rests upon a mixture of contradiction and contrariety, logical negation and real opposition.

In order to determine the relation between being and thought, Trendelenburg appealed to an originary activity common to both which he identifies as movement. Such move-

ment performs a unifying function in so far as it is at once the fundamental phenomenon of nature and the *constructive movement* of consciousness. By way of this movement, Trendelenburg was then able to establish the final connections of organic being, without reference to mechanical causality, thereby leading to a new teleological reading of the categories identified hitherto as causality, substance, quantity, quality, measure, part-whole, and reciprocity.

The system of the sciences, then, is structured according to the teleological principle that their order corresponds to the grades of knowledge, namely the mathematical, the physical, the organic, and the ethical. The system culminates in the ideas of the Absolute, which, as a limit-idea, cannot be determined by means of the categories of the infinite, but can be reached only by analogy. In this sense Trendelenburg criticized the traditional demonstration of the existence of God. The ethical, juridical, and political sciences also occupy an important place within the organic and finalistic thought of Trendelenburg. The origin and end of moral action is the idea of being human, which man has the task of realizing within the spheres of society and state.

Trendelenburg was very influential, and amongst those who attended his classes were Franz Brentano, Wilhelm Dilthey, Søren Kierkegaard, Ludwig Feuerbach, and Karl Marx. His logic and metaphysics were discussed above all by Franz Brentano, Hermann Cohen, Rudolph Eucken, and Friedrich Überweg; while his critique of Hegel's dialectic drew the attention of Feuerbach and Kierkegaard and led to the 'reform of the dialectic' by Kuno Fischer and by the early Italian neo-idealists (Bertrando Spaventa, Giovanni Gentile).

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FRANCO VOLPI

Truth

In the philosophical tradition since Plato a strong connection between truth and ontology has been repeatedly recognized. One of the classical formulations of this idea is Aristotle's "To say of what is that it is and of what is not that it is not is true" (*Met.* 1011 b 27). The most important and famous expression of the view, however, is the so-called correspondence theory of truth, whose main intention is to relate truth to reality in one or other sense. This idea, which was criticized by Gottlob Frege, is no longer uncontroversial in contemporary philosophy. Several accounts of the concept of truth have been developed which deny any direct connection between truth and ontology. Among such accounts one should include some forms of the redundancy theory (e.g., the so-called 'deflationary theories'), the pragmatic theories (e.g., the performance theory, the epistemic theory, the consensus theory, the dialogue theory, the valuation theory), and some variants of the early coherence theory (e.g. Otto Neurath). What these theories have in common is either an explanation of the concept of truth that rules out a *theory* of truth as such, or the explicit denial of any bearing of truth on ontological questions.

The intuitive meaning of the concept of truth seems, however, to lend support to an ontological theory. One of the best formulations of this intuitive meaning has been presented by Alfred Tarski in the introduction to his *The concept of truth in formalized languages* of 1933: "A true sentence is one which says that the state of affairs is so and so, and the state of affairs is indeed so and so". To be sure, this intuitive meaning is not

necessarily the only criterion for the adequacy of a theory of truth. But it is still an important criterion.

One can hardly deny that there is, in some sense or other, a relationship between language or thought and reality (or the world). Indeed, we really do speak about things in the world and the sciences are held to develop theories about how things are in the world. Traditionally, it has been always assumed in Western philosophy that this relationship is articulated by the concept of truth. If it could be shown that the expression 'truth' does not have this (intuitive) meaning, it would follow that a new word would have to be devised in order to express this connection, and then it would be this latter that would be the object of what follows.

It is well known that in elementary predicate logic it is possible to define a function from the set X of sentences of a language L to the set of truth-values $\{T, F\}$. A formula φ of L is said to be *true in* an L-structure $\mathfrak{A}$, or in symbols

(1) $\mathfrak{A} \models \varphi$,

if and only if the truth-value assigned to φ by the L-structure $\mathfrak{A}$ is T. The statement (1) is often read as: $\mathfrak{A}$ is a model of φ, or sometimes as: $\mathfrak{A}$ makes φ true. Some authors consider the relation of *making true* to be sufficient to establish the ontological nature of the concept of truth. But this view seems wrong, since the model (or structure) which makes true the sentence φ is not necessarily an ontologically justifiable or purely ontological model; it could, for example, be an epistemic one. What, then, is characteristic of an *ontological* approach?

Different ontological accounts have been proposed and defended. In the truth-theoretical perspective the most important ontologies are the ontology of *objects*, the ontology of *moments*, and the ontology of *facts*. Objects, moments, or facts are the entities which play the role of *truth makers*, i.e. they are the entities in virtue of which sentences are true or are held to be true.

The ontology of *objects* is the most commonly accepted contemporary ontology. 'Object' is taken as synonymous with 'particular' or 'individual' or sometimes 'substance'. The notion of object is generally considered to be a primitive notion, at least in the sense that it is not actually analysed, and it is often taken to be unanalysable. The world is then determined as the totality of objects, and the reference or denotation of singular terms (and individual variables) is explained in terms of the ontology of objects. It is not the sentence, but rather the singular term, that plays the fundamental semantical role. The concept of truth, then, turns out to be a secondary concept. The ontology of truth is provided already via the reference of the singular terms. The explication of the truth of a singular atomic sentence amounts to a reduction of the truth-concept to the concept of reference or denotation of a singular term and to the concept of application of a predicate to the object denoted:

> (2) A sentence 'Pn' for some predicate P and a name n of a language L is true in L if and only if there is an object o such that n refers in L to o and P applies to o.

The strength of this conception is its simplicity. But this strength has its price: the explanation of the concept of truth on the basis of an ontology of objects is a poor one, since it relies on the problematic assumption that 'objects' are primitively 'given' entities, thus barring questioning of their structure and status. Consequently, the concept of 'application' of a predicate to an object, too, remains unaccounted for, for all its elegant formal representation.

Recently, the main features of a theory of *moments* as truth-makers have been developed:

> A moment is an existentially dependent or non-self-sufficient object, that is, an object which is of such a nature that it cannot exist alone, but requires the existence of some other object outside itself (Mulligan, Simons, and Smith, 1983–4).

Examples of moments would be accidents or particularized qualities, boundaries, the 'modes' of René Descartes, John Locke, and David Hume. According to this theory, what makes it true that Socrates died is Socrates' death; what makes it true that Mary is smiling

is her (present) smile, and so on. Tarski-biconditionals of the form

(3) 'Snow is white' is true iff snow is white

are thereby replaced by sentences of the form

(3′) If 'snow is white' is true, then it is true *in virtue of* the being white (the whiteness) of snow, and if no such whitenessexists, then 'snow is white' is false (op. cit.).

Several arguments have been offered in favour of the existence of moments. Some of them do not rely on the analysis of the making-true relation. One central argument relies on the premiss that there are episodic mental acts such as seeings, hearings, and the like, which have as their objects not only John, a chair, and so on, but also such entities as the roughness of the chair, Mary's voice, the anger in Mary's voice, John's smile, and so on. Such entities are called 'moments'.

Even if the existence of moments is accepted, however, it seems difficult to maintain that all truth-makers are moments. The defenders of the ontology of moments themselves point out that there are at least four kinds of sentences which resist the general thesis: predications like 'John is a man', singular existentials such as 'John exists', identities like 'Hesperus = Phosphorus', and sentences about ideal objects. Thus the view that moments can be truth-makers would in any case need to be supplemented in some way to account for cases of these sorts. The authors mentioned above do, however, emphasize one merit of the moment theory over rival theories which introduce a special category of non-objectual entities (propositions, states of affairs, facts): we are unproblematically acquainted with things and moments, where other kinds of entities are less firmly tied into our ontology and epistemology. There seems to be little evidence for this last claim. Whether an ontology and an epistemology are well founded or not depends on many factors belonging to different areas, especially logic and philosophy of language. Moreover there is an immanent problem with this ontology: it admits objects as primitive entities.

The *third* kind of ontology of truth is the ontology of *facts*. To say that a sentence s is true, in this view, is to say that there is a fact which exactly corresponds to s. Some authors explain the sense of the correspondence relation by taking facts as truth-makers. The *making-true* relation is then defined as a relation which is always relative to

1. a world W;
2. a meaning or interpretation function M whose domain consists of individual constants and n-place predicates and whose range consists of individuals and n-place properties;
3. an assignment A, which is a function from the set of individual variables into the set of individuals.

There are different accounts of what a fact is. According to one approach, a set of *facts* is an actual *state of affairs* and a set of situations is a possible state of affairs. A situation is then taken to be a possible atomic fact and is defined with respect to a logical space K: $<D, \{P_1, P_2, \ldots, P_n \ldots\}>$ consisting of a domain of individuals D and a collection of n-place properties P. Accordingly, $<p, x_1, \ldots, x_n>$ is a situation in K iff p is an n-place property and $x_1, \ldots, x_n$ are individuals in K (see Barwise and Perry 1983, Taylor 1985, Pendlebury 1986).

The main problem with this kind of ontology concerns the relationship between facts and objects. Since objects are taken to be constituents of facts, they seem to be more primitive than facts. But then the question arises: what are objects? Moreover, do facts add something to (the notion of) object? Ontologically speaking, how exactly is an entity like $<P, x_1, \ldots, x_n>$ to be understood? Explaining this as something like a *juxtaposition* of one entity with another would be a very poor ontological conception.

For the first ontology the world is the totality of objects; for the second it is a totality of objects and moments; according to the third it is the totality of objects and facts. There is, however, a fourth ontological approach which avoids many of the difficulties inherent in these three ontologies. One famous formulation of this approach is

the second sentence in Ludwig Wittgenstein's *Tractatus*: "The world is the totality of facts, not of things". Another formulation can be found in the work of F. B. Fitch: "Propositions as the only realities". This conception does not deny that there are objects (things, individuals), events, processes, and the like. It merely states that facts, understood as existing states of affairs or existing propositions, are fundamental in the sense that all other entities are built up from these. Another way to express this thesis is to say that all other entities are *reduced* or *reducible* to facts (e.g. Levison 1983–4). This conception is however acceptable only if it is able to present a completely new explication of what entities like 'propositions', 'states of affairs', 'facts', and the like are (perhaps of the sort that is attempted in Puntel 1989).

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LORENZ B. PUNTEL

Truth Theory

Truth theory has a long philosophical tradition, going back to Plato and Aristotle. Truth theory in the Tarskian sense – which is the topic of this article – is a relatively new branch within this field of philosophical enquiry, starting with A. Tarski's epoch-making monograph *On the Concept of Truth in Formalized Languages* (1935). This essay, which is Tarski's main work on truth, appeared first in Polish in 1933 (under a slightly different title) and two years later in German. An English translation was first published in 1956. To the translations was added a postscript in which some views that had been stated in the Polish original underwent a number of rather crucial revisions. Less formal and much abbreviated presentations of the fundamentals of his truth theory were given by Tarski in two papers, "The establishment of scientific semantics" (1936) and "The semantic conception of truth and the foundations of semantics" (1944).

Truth theory in the Tarskian sense aims at giving a definition of the term 'true sentence'. But since a sentence always belongs to some language L, what really has to be defined is a term like 'true sentence in L'. However, since there are languages of many different kinds, the problem is to develop *general techniques for defining* 'true sentence in L', where L can be any language within a wide range of languages. But every definition is itself formulated in one or more sentences of some language. Hence we must, according to Tarski, distinguish between

1. the language L, which is the object of our investigation when we try to define 'true sentence in L' or when we describe a method which will yield such a definition, and
2. the language, in which this investigation is carried out,

that is between 1. the language *about* which we speak and 2. the language *in* which we speak. Usually the first language is called the *object language* and the second the *metalanguage*. Let us assume for the sake of simplicity that English (perhaps equipped with certain special devices) is our metalanguage.

Tarski stresses that the required truth-definition must be formally correct and materially adequate. The *formal correctness* of a definition guarantees its consistency (relative to the consistency of the defining notions). Since in everyday life as well as in mathematical, scientific, and philosophical discourse we often talk about true sentences,

and since the usual semantic definitions of logical consequence and of satisfiability presuppose a concept of truth, it is of the utmost importance to make sure that this concept can be used in a precise and consistent way.

A definition of 'true sentence in L' is *materially adequate* according to Tarski if and only if it grasps the intentions which underlie the classical (or correspondence) theory of truth: a sentence x in L is true in this sense if and only if x corresponds with reality, that is if and only if the state of affairs expressed by x is a fact. More precisely (and this is the essential content of Tarski's "Convention T"): a formally correct definition D of 'true sentence in L' is materially adequate if D (supplemented by definitions of concepts occurring in the definiens of D) has among its logical consequences all English sentences of the form

(T) x is a true sentence in L if and only if p

where p is replaced by a sentence y in L or – if y is not an English sentence – by a translation of y into English, and 'x' is replaced by a name of y. For instance, if a definition of 'true sentence in German' is to be materially adequate, then all English sentences like

(T_1) '*Es schneit*' is a true sentence in German if and only if it is snowing

must be provable with the help of this definition. Let L be some language; then by a Tarskian *true-definition* (TTD) *for* L we shall understand any (English) definition of 'true sentence in L' which is both formally correct and materially adequate.

Tarski insists that the construction of a TTD for some language L is possible only if the following necessary conditions are fulfilled:

(1) L must not be a semantically universal language,
(2) L must be a formalized language,
(3) L must not be a formal language (in a certain special sense of 'formal') and
(4) the meta-language of L must in two respects be richer than L.

These presuppositions will be briefly explained.

(1) L is a *semantically universal language* if and only if L contains both (a) semantical concepts like 'is true', 'is a name of', etc., and (b) for each expression in L a name of that expression. Thus, for instance, for each sentence x in L there is a sentence y in L which asserts or denies that x is true. Take one such semantically universal language, say Everyday English. Using a simple trick we can construct in Everyday English a self-referential sentence s asserting that s is not true. Now assume that D is some materially adequate definition of 'true sentence in Everyday English'. Then from D there follows a sentence of the form (T) where 'p' is replaced by s and 'x' by a name of s. But this sentence can – relying on very plausible premisses – be shown to lead to a contradiction (the so-called "Liar antinomy"). Hence D itself is inconsistent and therefore not formally correct.

(2) L is a *formalized language* if and only if the set of all sentences in L is formally decidable, which means that, of every given expression in L, we can decide by considering only its shape whether or not it is a sentence in L. If L is a formalized language, then the term 'sentence in L' is defined with great precision and this is a necessary condition for an exact definition of 'true sentence in L'.

(3) Logicians often use 'formal language' as synonymous with 'formalized language' in the sense just explained. But Tarski points to another sense of 'formal', emphasizing that if by a *formal language* we understand a language whose signs, terms, and sentences lack definite meaning, then the task of constructing a TTD for such a language is simply nonsense: one cannot speak of the truth of meaningless sentences.

(4) Since in the meta-language of L for every sentence x in L there must be a sentence of type (T) containing x or a translation of x as a proper part, everything expressible in L must also be expressible in the meta-language of L. But in two respects the meta-language of L must contain elements not in L: (a) in its non-logical part the meta-language of L must contain semantical terms, especially, of course, the term 'true

sentence in L'. Moreover, it must contain expressions referring to certain sets of, or relations between, or operations on expressions of L, and also for every sentence x in L a name of x which can occur in the appropriate sentence of type (T); (b) in its logical part the meta-language of L needs variables which are of a higher order than those in L.

Assuming that a language L and its meta-language satisfy all these conditions, a TTD for L can be given, roughly, by providing:

1. A characterization of the meta-language in which the investigation is to be carried out.
2. A description of the object language L. An important part in this description is the definition of the concept of a *sentential function in L*. This concept is defined inductively by first defining *primitive sentential functions in L*. By applying to these any number of times and in any order any of given fundamental logical operations (negation, disjunction, universal quantification, etc.) we obtain the sentential functions in L, which may contain free variables. Sentential functions in L without free variables are called *sentences in L*.
3. An inductive definition of satisfaction (which is the most distinctive feature of Tarski's truth theory). More specifically, Tarski defines the notion of *satisfaction of a sentential function in L by an infinite sequence of objects*. This definition is given by first stating the exact conditions under which a primitive sentential function in L is satisfied by an infinite sequence of objects. One must then fix which infinite sequences satisfy the sentential functions which are obtained from simpler sentential functions by means of one of the fundamental logical operations assuming that it has already been established which infinite sequences satisfy these simpler sentential functions. Given an enumeration of all variables in L, we can say that infinite sequences *agree with respect to the nth variable* (in this enumeration) if and only if the nth member of the one sequence is identical with the nth member of the other sequence. Now it is a logical consequence of Tarski's definition of satisfaction that of two infinite sequences which agree with respect to *all free variables* in a given sentential function x, one of them satisfies x if and only if the other satisfies x. Therefore every sentence in L is satisfied either by every or by no infinite sequence.
4. The required TTD for L can now be given by defining, for all expressions x in L:

   x is a true sentence in L if and only if x is a sentence in L and every infinite sequence of objects satisfies x.

See also: **Tarski**

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REINHARD KAMITZ

Twardowski, Kazimierz

Kazimierz Twardowski (1866–1938) was born in Vienna. In 1885–9 he studied philosophy in Vienna, where Franz Brentano was his principal teacher. He obtained his Ph.D. in 1892 with a work entitled *Idee und Perzeption. Eine erkenntnistheoretische Studie aus Descartes*, published in 1891. Due to Brentano's problematic situation in Vienna, Twardowski's official supervisor was Robert Zimmermann. In 1894 Twardowski obtained his habilitation degree from Vienna University with the monograph *Zur Lehre vom Inhalt und Gegenstand der Vorstellungen*, published in the same year. He lectured as *Privatdozent* in Vienna in 1894–5 and in 1895 he was appointed a professor of philosophy at

Lvov University. At that time, Lvov belonged to the Austro-Hungarian Empire and had the German name of Lemberg. Twardowski's activity as a teacher was extremely successful. He established the Lvov-Warsaw philosophical school and trained many distinguished Polish logicians and analytic philosophers, including Kazimierz Ajdukiewicz, Tadeusz Czeżowski, Tadeusz Kotarbiński, Stanisław Leśniewski, Jan Łukasiewicz, Władysław Tatarkiewicz, and Zygmunt Zawirski.

Twardowski's principal field of work as a philosopher was psychology, together with philosophical semantics, ontology, and epistemology. Following Brentano, and also influenced to some extent by Bernard Bolzano and Anton Marty, Twardowski embraced a Brentanian idea of philosophy as a science based on descriptive psychology. He adopted also Brentano's method of analysis together with his realism, intentional conception of mental acts, and the absolute conception of truth.

Twardowski's main contribution to the Brentanian tradition consists in his having added to the famous distinction between act and object of presentations a third element – the content of presentation. According to Twardowski, the word 'presented' in the expression 'a presented object' may function either as a determiner or as a modifier. This distinction enabled Twardowski to formulate a new realistic theory of the objects of intentional acts. Generally speaking, an adjective is a modifier if it alters the sense of a name which it is attached to. For instance, the adjective 'false' in the context 'false gold' is a modifier, since false gold is no gold at all. On the other hand, 'false' in the context 'a false sentence' is a determiner, since false sentences are genuine sentences. If, now, one uses the expression 'presented object', one can refer either to an object – for example, this book – that is presented by someone, or to a content which exists in someone's mind, according to whether the word 'presented' is a determiner or a modifier. Thus, Twardowski comes to the conclusion that the idealistic thesis that contents are the genuine objects of our presentations is simply based on the ambiguity of the word 'presented'.

Twardowski's monograph on contents and objects of 1894 initiates also the general theory of objects. He argued that there are no objectless presentations. In particular, the word 'nothing' is not a name but a syncategorematic expression which is for this reason not linked with any presentation. Moreover, Twardowski argued for the existence of general objects and developed a theory of parts and wholes.

Twardowski's distinction of act, content, and object of presentation, as well as his contributions to the theory of objects, influenced both Alexius Meinong and Edmund Husserl. Twardowski's considerable teaching duties restricted his scientific activity in later life. Perhaps the most important of his writings in the Lvov period is connected with the distinction between actions and products. This Twardowski believed would provide the basis for a non-psychologistic interpretation of logic and the humanities. The distinction strongly influenced Polish analytic philosophy, especially the philosophy of science and philosophy of language of the Lvov-Warsaw School.

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JAN WOLEŃSKI

Types and Tokens

The type–token distinction was first introduced by C. S. Peirce in developing his theory of signs. Since then it has been extended to apply to a wide range of non-linguistic phenomena, including both actions and events.

The Core Distinction. Peirce pointed out that erasing a word from a page does not destroy a symbol from the language; it simply removes an instance of that symbol. The symbol itself is the *type* and its instances or embodiments are *tokens*, or replicas. Peirce argued that a type itself does not exist, but has "a real being, consisting in the fact that existence will conform to it" (*Collected Works*, Volume 2, paragraph 292).

Thus if we say that in the preceding paragraph the word 'Peirce' occurs twice, we mean that two tokens or instances of it occur there. These tokens occupy a determinate amount of space and thus play a causal role in determining the relative locations of the other tokens in the paragraph. Printing them used small, but measurable, quantities of ink. Word *types*, by contrast, take up no space, use none of the printer's resources, and play no causal role in the work of the typesetter.

Likewise there is an ambiguity in the term 'paragraph'. In what has just been written, reference was intended to paragraph tokens. Readers of different copies of the present book will be looking at different occurrences – tokens – of the same paragraph type. The paragraph tokens are what contain the tokens of the word 'Peirce'. If, by contrast, it was thought that reference was being made to a paragraph type, then the description in the previous paragraph would imply that types can contain tokens as parts. Such a suggestion would immediately raise puzzles over how an 'abstract' item could contain a 'concrete' part.

The Status of Types. Recent work by analytic philosophers has raised difficult questions about the nature of types. Attempts at clarification have often involved the use of further problematic notions such as *similarity*, *replication*, *abstractness*, and *pattern*. One fairly natural suggestion is that expression types are sets. Suppose that the primitive expressions of a language are sets of perceptible tokens (all of which are *similar* to certain given tokens): then all other expression types can be regarded as constructions from the primitive ones (see Hugly and Sayward 1981). The idea here is reminiscent of W. V. O. Quine's suggestion that sentences be regarded as sets of phonemes. It would then not matter that there will always be infinitely many sentences which are never uttered. For every phoneme is tokened, and so the entire infinite construction is anchored in finite reality.

Although it is formally attractive to treat expression types as sets, the artificiality of the proposal can be criticized. For example, since all the sets are generated from a basic set of tokens, the identity of types will depend, somewhat arbitrarily, on which tokens ever have been, or will be, produced. Thus if there had been one fewer in the list of the primitive tokens from which all the other expressions in a language are constructed, then any expression type ('¬Fa', say) would have been a different set, hence, implausibly, a different type, from the one it in fact is.

Structures, Patterns and Replication. Another problem with the set-theoretical account of types is its use of the notion of *similarity*. Those who are puzzled by the conditions for physical similarity required in specifying the basic sets of tokens may find it useful to think instead in terms of patterns A complex token may then turn out to be an instance of more than one pattern, in the way that 'Jane is wise' exemplifies both the patterns 'x is wise' and 'Jane φ' (Simons 1982). But nominalists will find the appeal to patterns unhelpful. There seems to be a fairly stark choice between appeal to patterns on the one side and, on the other, regarding discourse about types as no more than shorthand for referring to similarity relations among tokens. In the end, it is not clear that either way of explicating the nature of types is particularly helpful.

Reflection on the ideas of similarity and *replication* may suggest that any item which can be replicated will be subject to the duality of type and token. Although we do not have the technology to do so, we might consider it at least possible to replicate, in precise detail, desks, mountains, or even people. If we were to be able to do so, then we could distinguish types of each from their token instances. Cloning of plants gives us something of the same sort. Each member of a clone, we might argue, is a token of the same type as the original.

Less controversial than these cases is the extension of the vocabulary of types and

tokens to events and actions. Physicalist theories of the mind may be type–type (in which case, a mental event type is occurring if and only if some brain event type is occurring). Alternatively, they may be token–token (that is, each token mental event is the same as some token physical brain event or other). Given what we know about the functional equivalence possible between very different hardware configurations in computers, and the likely functional sophistication of the brain, token–token identity theories look to be the more plausible of the two.

Again, human actions can be distinguished into types or tokens. The idea of an action type is very like the idea of a kind or sort of action. As in the linguistic case, the use of the type–token vocabulary here draws attention to the fact that different actions can have structural similarity (or be examples of the same pattern). It immediately follows that different theories of the structure of particulars, actions, and events may well yield different accounts of what is a token of what.

Behind the seemingly innocuous use of the type–token distinction, however, is the possibility that thinking of events, actions, and particular things in terms of it is liable to undermine the conception of these items as part of the basic furniture of the universe. This worry becomes acute when we consider, as Derek Parfit and Bernard Williams have both urged, the issue of whether persons are best thought of as types rather than tokens. The introduction of the distinction in a context like this raises a significant ontological issue which we are not yet in a position to resolve.

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U

Unity

The topic of unity embraces at least two kinds of questions, a question about the nature of the *synchronic* unity of a thing's parts and a question about the nature of the *diachronic* unity of a thing's successive stages. The latter question has been discussed more extensively in the literature, under the heading of 'identity through time'.

It may seem immediately obvious that prior to tackling such questions, one must first subdivide 'things' into more limited categories, for it does not seem likely that one can provide a univocal account of the unity of items belonging to highly disparate categories, such as bodies, events, and sets.

A more surprising claim, however, has been influentially advanced by David Wiggins. According to him, even within the category of physical bodies, no general account of unity can be usefully given. An account of the unity of bodies needs, rather, to be couched in terms of relatively specific *sortals*, such as 'tree', 'river', and 'table', and in terms of the distinctive forms of continuity of change characteristic of different sorts of things (Wiggins 1980, Chapters 2 and 3).

It may be objected that Wiggins's claim runs against the intuition that people can make reliably accurate judgements of unity even if they do not know how to apply any specific sortal to the thing in question. For example, a person who has never seen a car before, who knows nothing about cars, and who has no command of the sortal 'car' (or any closely related sortal) can be expected, when first presented with a car, to make essentially accurate judgements about its synchronic and diachronic unity.

It may be argued, therefore, that whereas Wiggins's claim implies that our account of unity must be relativized to sortals, we can in fact provide a sortal-neutral account. Synchronic unity might be explained along the lines of literature in Gestalt psychology: some bits of matter constitute a unitary thing if they are sufficiently connected spatially,

qualitatively, and causally (Köhler 1947, Chapters 5 and 6). Diachronic unity might be explained along the following lines: to trace the career of a body, one follows a path that is spatially, qualitatively, and causally continuous and that minimizes change as far as possible (Hirsch 1982, Chapter 3).

These sortal-neutral accounts may seem to provide at least an approximately accurate characterization of a body's unity and they would explain how someone can make correct judgements of unity even in sortal ignorance.

It might be suggested, however, as a kind of compromise position, that Wiggins is still right in insisting that a completely accurate account of unity requires sortal-relativization. If, for example, a car has no bumpers and then bumpers are added, the sortal-neutral account, in terms of change – minimizing continuity – will not tell us whether the original object acquires bumpers or remains bumperlessly sandwiched in between the two bumpers. In general, it might be said, the sortal-neutral account provides a good approximation, but to settle fine points, one needs to bring in the sortals.

Within the category of a physical body, a further distinction has been made, that between an *articulated* body and a *bit of matter*. Whereas it has generally been supposed that the unity of an articulated body, such as a tree, or a car, or a river can be analysed in some useful way, it has been argued that the diachronic unity of a bit of matter is ultimate and unanalysable. As Bertrand Russell pointed out, through a homogeneous bit of matter, one can trace any number of continuous paths that do not correspond to the paths of any bit of matter (Russell 1917, p. 171). It may appear, therefore, that considerations of continuity are quite useless in analysing the unity of matter and that this mode of unity must be accepted as primitive.

Primitive unity has been claimed not only for matter but, in some literature, for *persons*. One kind of argument has been that the diachronic unity of a person is not dependent on any form of continuity.

Some have claimed, furthermore, that unless a form of unity is primitive, it is not genuine. Samuel Butler (1835–1902), for example, held that only matter and persons have genuine identity through time, that the identity attributed to bodies such as trees is merely a loose way of talking (Perry 1975, pp. 99–105). As against this, it has been objected that to analyse a phenomenon is not to deny its genuineness; often indeed to analyse something is to clarify it and to remove any doubts about its reality.

It might be suggested, however, somewhat in the spirit of Butler's view, that where our concept of unity is analysable in terms of some complexity, it is *metaphysically arbitrary*, that it is merely the result of the human mind's putting things together in a certain way rather than various other equally legitimate ways. Only in the cases of primitive unity is our concept of unity constrained by something in the world.

If our concept of unity is indeed metaphysically arbitrary in many typical cases, the question arises as to why we operate with such a concept. Some have seemed to answer this question by saying that there are *pragmatic* reasons for our having this concept, while others have seemed to imply that our concept of unity derives largely from purely contingent facts of human psychology or linguistic convention.

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ELI HIRSCH

Universals

'Universal' is an adjective contrary to the adjective 'individual'. In ontological contexts both terms are used as substantives designating two (according to modern estimation) mutually exclusive but interrelated funda-

mental kinds of entities: universals and individuals (for example: redness, beauty, love; vs. this blush, Helen, Romeo and Juliet).

Historically there have been, and there still are, three central ontological problems concerning universals:

1. The problem of definition (or description): what are universals?
2. The problem of existence: are there universals?
3. The problem of exemplification: what is the relation between universals and individuals?

Together these form the so-called 'problem of universals', whose earliest formulation is to be found in the first part of Plato's dialogue *Parmenides*, a philosophical text documenting Plato's loss of *naïveté* concerning universals, entities that he himself, leaving aside some inklings of the Pythagoreans, was the first to envisage. In the *Parmenides* Plato also poses an epistemological question with respect to universals: is there knowledge purely of universals? In view of the fact that he originally held knowledge purely of universals to be the only knowledge in the strict sense, and the presupposition of all merely probable 'knowledge', it is especially in the posing of this question that his new critical attitude toward universals becomes apparent.

What are universals, and what is their relation to individuals? The problem of definition is closely related to the problem of exemplification: individuals are said to *exemplify* universals, and the definition of the latter will be largely determined by their role in the exemplification-relation, also expressed by means of quasi-metaphorical formulations such as: '(universal) *F is in* (individual) *b*', '*b falls under F*', '*b participates in F*', '*b satisfies F*'. These, however, fall short of explications.

The three most important accounts of exemplification in the literature are:

b exemplifies F = Df.

(i) *b* is sufficiently similar to F (Plato).

(ii) the F of *b* exists (based on Aristotle, Aquinas).

(iii) the value of F for *b* and the real world is *the true* (intensional semantics originating in Gottlob Frege and Rudolf Carnap).

(Here and in the definitions that follow it is to be assumed that $b, b_1, \ldots, b_n$ are individuals, and F (or F^n or $\lambda x_1 \ldots x_n A(x_1, \ldots, x_n)$) is a universal.) These determine three accounts of the definition-problem:

(i') A universal is an ideal type copied by (non-ideal) individuals.

(ii') A universal is a function whose argument in each case is an individual and whose value is an individual feature (accident, moment, aspect) in (or more generally: with respect to) this individual.

(iii') A universal is a function whose arguments in each case are one individual and one possible world, and whose value is a truth-value.

Here the word 'function' must not be understood in the set-theoretic sense, but taken to signify the primitive concept introduced by Frege: functions, in contrast to individuals (*Gegenstände*) are incomplete (*ungesättigte*) entities. A function in the set-theoretic sense, on the other hand, is an individual (a set of ordered pairs); but no universal (that is, no non-Platonic universal) is an individual; thus no universal can be a function in the set-theoretic sense.

Any adequate explication of universals and exemplification must be able to cope with the assumption that not all universals are *properties (monadic universals* like ugliness, the colour red, justice), but that some universals are *relations (polyadic universals* like parenthood, being-greater-than, love). (iii) and (iii') can be duly generalized to:

$b_1, \ldots, b_n$ exemplify F^n = Df.

(iii*) the value of F^n for $b_1, \ldots, b_n$ and the real world is the true.

(iii'*) an n-adic universal is a function whose arguments in each case are n ($1 \leq n$) individuals (in a certain order) and one possible world, and whose value is a truth-value.

It is a positive aspect of (iii) and (iii') – which have served as the recently dominant para-

digm – that they allow this generalization. They have the disadvantage, however, that the notions of *possible world* and *truth-value* are ontologically problematic. It seems unlikely that (i) and (i') could similarly be generalized to accommodate relational universals. But in the case of (ii) and (ii') such a generalization is available:

(ii*) the F^n of $b_1, \ldots, b_n$ exists.

Thus Jack, Jill exemplify love iff the love of Jack for Jill exists. (ii*) determines the generalization of (ii'):

(ii'*) an n-adic universal is a function whose arguments in each case are n individuals (in a certain order) and whose value is an individual feature in or between (or more generally: with respect to) these individuals (in this order).

What were called 'universals' in (i')–(iii') can now more properly be seen to be monadic universals.

(ii) and (ii') avoid the problematic notions of possible world and truth-value. They appeal instead to *individual features* (the redness of John's hair, the beauty of Geraldine). While the existence of individual features is apparently less problematic than the existence of possible worlds, the concept of individual feature seems much less precise than that of possible world. Moreover (iii) and (iii') are so far the only positions which provide an identity-principle for universals that approaches adequacy without the need for modal operators.

Consider finally the following, as it were 'neutral', account of exemplification and universals:

$b_1, \ldots, b_n$ exemplify
$\lambda y_1 \ldots y_n A(y_1, \ldots, y_n)$ = Df.
(iv*) $A(b_1, \ldots, b_n)$.
(iv'*) $\lambda y_1 \ldots y_n A(y_1, \ldots, y_n)$ is an n-adic universal iff necessarily for all $y_1, \ldots, y_n$: if $A(y_1, \ldots, y_n)$, then $y_1, \ldots, y_n$ are individuals.

(iv*) and (iv'*) offer only partial solutions to the problems of exemplification and definition; that is, they offer solutions only in relation to entities *named* in the given fashion with the help of predicates: λ is a name-forming operator on n-adic predicates $A(x_1, \ldots, x_n)$ not containing the word 'exemplify' or defined with its help. As far as it goes, (iv*) is correct, expressing the core of our intuitions about exemplification and universals. (iv'*), however, is in a way more problematic than either (ii'*) or (iii'*), for it makes it almost too easy to show that there are universals.

Nominalism. Nominalism, in one version, affirms that there are no universals; in another version it affirms that there are no abstract individuals; in yet another version it affirms that there are no abstract entities of any kind. If universals are abstract entities, then this third version is nominalism in the strongest sense: it then denies universals and all other abstract entities, including propositions and second-order universals such as *being-a-colour, transitivity, exemplification* etc., which are related to universals properly so called – and in some cases to universals *and* individuals – as universals are to individuals.

This position has not found many advocates among ontologists, though one recent well-known proponent is Nelson Goodman. Much of modern ontology, however, for example the ontology involved in the usual possible-world semantics, is nominalistic in the first sense, since it operates within the framework of set theory, which allows the modelling of universals by abstract individuals, i.e. sets. The set-theoretic substitutes for universals are defined with reference to possible worlds; they mimic the non-extensionality of properties and relations and enter into the ontological roles of universals, rendering them superfluous. Clearly, the nominalism of set-theoretic possible-worlds-semantics, steeped, as it were, in abstract individuals, is a far cry from nominalism in the second and third of the senses distinguished above.

Are universals abstract entities? If they are, then the three nominalisms have the common denominator that they are all opposed to one or other kind of abstract entity. Putative designators of the abstract entities falling under disfavour are considered to be 'mere names', at best only syncategorematically meaningful; hence the term 'nominalism'. If universals are not

abstract entities, or if at least some of them are not, then *individualism* (nominalism in the first version) is quite a different nominalism from the other two sorts distinguished. The first nominalists – Roscelin and Abelard – were ontological individualists, the heralds of other individualisms yet to come. They directed their criticisms against universals, but against universals conceived as abstract entities.

It seems correct to say that all abstract individuals are non-empirical entities, entities that are essentially not spatio-temporally located. Moreover, it seems correct to say that the abstract entities are precisely the non-empirical entities. Universals are essentially not spatio-temporally located; it makes no sense to ask 'Where is the colour red now?' (where it does make sense to ask 'Where are there now cases of redness?'). Hence universals are abstract entities.

Realism and Constructivism. The thesis that there are universals (or abstract individuals) does not by itself constitute realism with respect to universals (or abstract individuals), though the word 'realism' is indeed often used in this weak sense. Realism with respect to entities of a given sort means that there are such entities *and* that their existence is independent of (at least) the human mind.

It is unclear for which of the two realisms just mentioned the label *Platonism* should be reserved. The positions are distinct, since universals are abstract, but they are not individuals, while their set-theoretic duplicates are indeed abstract individuals. For Plato, however, universals themselves are abstract individuals. According to Plato's view of exemplification, a universal, being identical with itself and therefore maximally similar to itself, exemplifies itself if and only if it is also an individual. As is well known, universals in Plato's eyes are self-exemplifying. Therefore, universals are for Plato individuals, though of course abstract individuals.

As a matter of fact, the word 'Platonism' is in ontological contexts most often used for realism with respect to abstract individuals, more specifically: mathematical individuals. In this use of the word Frege was a Platonist, and so was Kurt Gödel. But, clearly, Frege does not share Plato's view of universals; he always insisted that universals (*Begriffe*) are not individuals (*Gegenstände*). Therefore, to call him a Platonist is somewhat unsuitable. If we want to apply the word 'Platonism' to a modern ontological position, realism with respect to both abstract individuals and to universals might most appropriately be so named.

Realism and *constructivism* (or *conceptualism*) are both opposed to nominalism, but they are also opposed to each other. Constructivism with respect to universals, contrary to nominalism, asserts that there are universals, but contrary to realism it asserts also that universals do not exist independently of the human mind; they are created by it. Aristotle may be said to have inaugurated constructivism with his theory of abstraction. A very different version of constructivism and one limited to mathematical entities is the *intuitionism* of L. E. J. Brouwer (1881–1966) and his followers, which has its roots in Kant. It is idealistic in outlook, while Aristotle's constructivism (like that of Aquinas) is realistic: the mind's constructions are based on and in a large measure determined by reality without the mind.

Constructivism is confronted with the task of explaining exactly in what sense abstract entities 'are created by the human mind', and available explications are less than clear. A hallucination may be called 'a creation of the human mind'; but abstract entities, being objective, are not creations of the human mind in this sense. Sherlock Holmes, or a hammer, may be said to be 'a creation of the human mind'; but abstract entities are non-fictitious, and they are immaterial, thus they cannot be creations of the human mind in either of these senses, either.

Abstract entities may be said to be created by the human mind through the creation of a language in which we formulate meaningful sentences we regard as true, and others we regard as false, where there exists no model adequate for these sentences in the empirical world (or at least no model that we know of). Our creation of abstract entities in this sense is not a whim, but is motivated by our interest in empirical knowledge and guided by objective features of the world, as is very

much apparent in the case of abstract geometrical objects and numbers. Thus, abstract entities come out as abstract tools ('tools of knowledge').

Constructivism avoids the possibly unfeasible asceticism of nominalism (without abstract entities it seems that we cannot systematize our experiences as effectively as with them). But at the same time it stays clear of the epistemological problem so very pressing for realism: what is the basis of our knowledge of facts that concern abstract entities conceived as independent of the human mind? Plato's answer was *anamnesis*, and realists seem not to have got much further than this. For constructivism there is no such epistemological problem. It is no wonder that we know a great deal about abstract entities if they are our own creations; no quasi-experience need be postulated to explain our knowledge in this respect. Yet the constructivist can accept, too, that we do not know all there is to know about abstract entities: our creations may be in some measure independent of their creators; they may lead lives of their own.

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UWE MEIXNER

V

Vagueness

The topic of vagueness (which is distinguished here from ambiguity) has bearing upon the phenomenology of perception, and upon issues in the philosophy of science such as verifiability and falsifiability, and the supposed 'exactness' of scientific knowledge in general. Within the philosophy of language, it is important to distinguish between intensional vagueness of a predicate $f(x)$ (when the range $\{x\}$ of its satisfying arguments may be unclear *in toto*) and its extensional vagueness (when there are values of x for which the satisfaction by f is uncertain).

By far the most developed theory of vagueness is fuzzy set theory, in which predicates are left vague and arguments belong to them with a numerical measure of membership lying between 0 and 1. For example, John is a tall man to the measure (say) of 0.44 if he is 5'5" tall, and to 0.88 if 5'11" tall. Fuzzy set membership is not a probability measure, although the theory can be used in harness with probability theory in some applications.

Upon this principle a non-classical set theory is constructed. The apparatus of the classical theory is adapted to allow the definition of combinations of fuzzy sets (their unions and intersection, for example). In addition, qualifying functors can be introduced ('very tall man', in the above example, where 'very' modifies the fuzzy set 'tall man'), and the theory can be extended to fuzzy relations. A non-classical logic emerges when a valuation function is applied to the theory; classical truth and falsehood then take the values 1 and 0 respectively. Existential and universal quantification are definable respectively in terms of maximal and minimal values of fuzzy memberships to the pertaining set: 'there is a tall man in Texas', for example, takes as its truth value the largest of the membership values found among the fuzzy set of tall men in Texas.

Fuzzy set theory was not initiated by logicians or philosophers but largely by engineers, especially L. A. Zadeh. In the twenty-five years of its life it has developed with remarkable speed, with a journal (*Fuzzy Sets and Systems*) founded in 1978, and its own section in the classification of mathematics in *Mathematical Reviews*. The theory has received extensive applications in engineering, psychology, programming, artificial intelligence, and linguistics; the latter topic

gives the closest contact with 'orthodox' philosophy, although it contradicts the essentialistic preferences which are currently dominant there.

The interest among philosophers and logicians in fuzzy set theory has been slight up to now, despite its considerable significance for their concerns. For example, the assignment of the numerical value to a fuzzy set is heavily dependent on context, and seems to require a refined theory of contextualization for its successful prosecution. Further, the use of a numerical value for fuzzy membership seems to contradict the principle of vagueness; and in fact the theory gains both conceptually and technically when interval membership is employed, for an interval is a set, and therefore a structure-isomorphism between fuzzy sets and intervals can be set up. Again, since the theory encompasses intensional vagueness, membership is itself fuzzy, so that parts of the metatheory have to be fuzzy also; little has yet been found out about such properties. There is plenty of scope for vagueness to be given a clear place in philosophy.

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IVOR GRATTAN-GUINNESS

Valla, Lorenzo. See: Renaissance Philosophy

Value Theory, Austrian

The history of the first Austrian school of value theory began in 1871 with the appearance of Carl Menger's *Principles of Economics*. Apart from Carl Menger (1840–1921), the chief representatives of the school were Eugen von Böhm-Bawerk (1851–1914) and Friedrich von Wieser (1851–1926).

The theory of the Menger school belongs to economic thought: its fundamental question is concerned with the nature of economic value. The solution it offers is a *marginal utility* theory, similar to other marginalist conceptions being put forward simultaneously by W. Stanley Jevons (1835–82) and Leon Walras (1834–1910).

The basic concept of marginal utility may be illustrated as follows. Let's assume that some hungry person consumes a first unit of food and gets 10 units of utility therefrom. The consumption of the second unit of food will bring him – we should agree – less utility, say 9 units; and so on to the tenth unit of food which will bring, say, a single unit. What will be the value of the stock of 5 units of food? Since every unit of that stock will have only marginal utility, i.e. the utility of the fifth unit of food, the value of the stock will be 5 (the number of units) × 6 (the marginal utility of the fifth unit) = 30 units of utility.

What determines the value is then the subjective point of view of an *individual consumer* who estimates the utility of a good according to his needs, and his degree of satisfaction. This point of view is a decisive factor for subsequent developments of the Austrian marginal utility idea in the areas of price theory, exchange theory, interest theory, and so on.

The second Austrian school of value theory was a philosophical school. Its inauguration was a lecture given before the Vienna Law Society on 23 January 1889 by Franz Brentano.

Brentano's aim was an explanation of the origin of our ethical knowledge. (The lecture's published version was entitled *On the Origin of Our Knowledge of Right and Wrong*.) Brentano starts with the classification of mental phenomena – he divides them into three classes: *presentations, judgements*, and *emotions*. He then maintains that phenomena of the second and third classes are in many respects analogous. One of the analogies is that in both domains a specific pair of opposing intentional relations is associated with an underlying presentation: it is the relation of acceptance or rejection in the case of judgements and the relation of *love* or *hate* in the case of emotions. The

analogy goes further: in both cases only one relation is correct; thus for every emotion either love or hate is correct. This leads to a simple definition of 'good': a thing is *good* if the love that is directed to it is correct. How do we know that a thing is good? The answer is that some of our acts of love are experienced as being correct. (Evident judgements supply us again with an analogy.) We know not only that some things are good but also that some are better than others. This is due to correct acts of *preference*. These two types of knowledge give us an orientation in the sphere of *practical good*.

Brentano's disciples – especially Alexius Meinong, Christian von Ehrenfels and Oskar Kraus (1872–1942) – shared his opinion that general investigations into the nature of value and into the nature of our axiological knowledge are both possible and needed. This basic agreement did not exclude serious controversies and discussions among them. One of these concentrated on the role intellect, feelings, and desires play in valuation.

An especially interesting way of combining emotional and intellectual elements is to be found in Meinong's axiological theory. This theory is part of a larger conception, called *theory of objects* (*Gegenstandstheorie*). Values are said to be objects of higher order. This means that they require as their presuppositions other objects – correlates of judgements and assumptions. Values are presented in acts of feelings and desires, the former being, in Meinong's opinion, of primary importance. Whether such a presentation is sound, is, however, apprehended only in value-judgements.

Both schools of Austrian value theory had much in common: Ehrenfels, for example, based his idea of a general value theory on the concept of marginal utility; F. von Wieser and E. von Böhm-Bawerk took up some psychological ideas of the Brentano school, and their methodology, like that of the Brentanians and like much Austrian thought, was rooted in certain Aristotelian elements.

In the light of this the label: *Austrian Value Theory* may be regarded as appropriate and justified.

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CZESŁAW PORĘBSKI

Variation

Familiarly, the circumference C of a circle varies directly with the diameter D, with π as the constant of proportionality. More generally, one may say that C is a function of D. This means that to each value D might take, there corresponds a unique value of C such that $C = \pi D$. The idea of a function is the idea of how an output, or value, varies with an input, or argument. The modern mathematical concentration on functions was probably conceived in the recognition of the centrality of functions in the articulation of the laws of nature.

When one throws a stone, one can watch its flight, so its motion is concrete and physical enough to be seen. But suppose one wants to put into words exactly how the stone moves. It is a fact worthy of remark that satisfying this simple desire leads to fairly abstract mathematical ideas. First of all, for each instant during the stone's flight, there is a unique position (or small volume) in space occupied by the stone. So one may think of how the stone moves as how its position varies with time; this way of thinking conceives the varying position of the stone as a function of time. It seems to have been Galileo who recognized the fundamentality of time as an independent variable in the laws of motion and the propagation of forces like the acceleration of gravity.

Second, we expect the stone to move continuously. The understanding can probably best grasp the idea of continuity by picturing a discontinuity. If a moving bus were in London before noon on a certain day, but in Paris from noon on, then the position of the bus would not be a continuous function of time. Note that if this were to happen, it would not be true that the position of the bus

would be confined to smaller and smaller volumes of space during shorter and shorter intervals of time around noon, for any such volume would have to remain big enough to include both London and Paris. To require continuity of motion is to rule out discontinuities of this sort.

This requires, however, that we have an idea of quantities like the length of an interval of time or the volume of a region of space. The values of such quantities are usually real numbers, that is, those for which our best approximation to a systematic notation is the system of infinite decimals. It was during the 19th century that mathematicians, like A. L. Cauchy (1789–1857), Karl Weierstrass (1815–97), and Richard Dedekind (1831–1916), articulated an axiomatic description of the basic laws of real numbers. With the characteristic abstraction of modern mathematics, let S be some arbitrary set; we are thinking of S as a space of points. Then a metric on S is a function d that assigns to any pair of members of S a unique real number subject to these constraints:

(1) $d(x,y) \geq 0$; and $d(x,y)=0$ iff $x=y$;
(2) $d(x,y)=d(y,x)$;
(3) $d(x,z) \leq d(x,y)+d(y,z)$.

We think of the number $d(x,y)$ as the distance from x to y. The third condition is called the triangle inequality; since a straight line is the shortest distance between two points, no side of a triangle is ever of a length greater than the sum of the lengths of the other two.

Suppose space and time are such that there are metrics representing the separation between points in space and the interval between instants in time. Then a function from time to space, such as a function representing the motion of a point particle through space, is a continuous function at an instant t_0 if and only if for every positive real ϵ, however small, there is a positive real δ such that in order to restrict the position $f(t)$ of the particle at t to positions within ϵ of $f(t_0)$, we need only restrict the time t to times within δ of t_0; and its motion is continuous if it is continuous at all times. This account illustrates the so-called ϵ–δ techniques that were fundamental to the programme of arithmetizing analysis during the 19th century. Arithmetization meant replacing geometrical ideas by numerical ones. For it had been learnt painfully that geometrical intuition could not be trusted to deliver true answers to mathematical questions raised during the development of analysis from the calculus founded by Sir Isaac Newton and Leibniz.

Continuous motion requires that small changes of position are fixed by confining the time variable to a small interval. The idea that small changes in input yield only small changes in output is perhaps an application of the ancient thought that one never really gets something for nothing or vice versa. If there really were magic – if, for example, a wizard could make rabbits come into being from nothing – then such utter discontinuities would falsify the presupposition of the question where the rabbit came from. Such falsification would undermine any systematic attempt to describe the course of nature. A Kantian might thus see it as a regulative principle that the functions in terms of which the basic laws of nature are stated be continuous functions. For if the output goes on increasing a great deal even as the increase in the input dwindles away, then we are getting something (the increase in the output) for less and less, and that too would be a sort of magic, which would seem to defy rational explanation. Conservation principles, like the conservation of energy or charge, might be seen as our attempt to fix basic sorts of quantities as presuppositions of the explanatory enterprise of science, that is, as something in terms of which to state answers to the question how this or that came about.

The quantificational dependencies in our ϵ–δ account of continuity are rather subtle, so it is no accident that the arithmetization of analysis went along with the development of quantification theory and the logic of relations. In the pure mathematics of this abstraction and generalization, the idea of a function as a process by which an input is converted into an output drops out of the most general idea of a function. All that remains is the requirement that a function assign to each of its arguments a unique value. So eventually, in set theory, one comes

to say that a function just is a set of ordered pairs such that different pairs in the set always have different first members.

The process of recasting mathematical practice in set-theoretic frameworks has been a prominent feature of our century. Gottlob Frege played no small part in this process, but he himself took the idea of a function as primitive. He extended his basic distinction, between objects and functions, to rival Aristotle's distinction between substances and qualities. Where Aristotle might have said that a substance has or lacks a property, Frege says that the value of a special sort of function, which he calls a concept, at that object is one of the two truth values, truth and falsity. Bertrand Russell's propositional functions have as their values not truth values but propositions; for the propositional function presented by the predicate 'is blue' and the sky as argument, the value according to Russell is not truth but the proposition that the sky is blue. It was in part such functional conceptions of the nature of the propositional bond that interested some philosophers in the idea of a function.

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W. D. HART

Veber, France

France Veber was born in 1890 in Radgona, Yugoslavia. He died in 1975. Veber studied in the 1910s under Alexius Meinong in Graz and started his philosophical career in Ljubljana as a faithful Meinongian object-theorist. However, after his most creative period in the early 1920s, during which he wrote, e.g., *Etika* (1923) and *Estetika* (1925), Veber grew increasingly dissatisfied with the theory of objects, especially its incapacity to do justice to the real things of the external world, as contrasted with their merely mental counterparts.

In his most original book, *Vprašanje stvarnosti* (*The Question of Reality* 1939), Veber argues that the human mind has two functions which Meinong's theory of objects is unable to distinguish: *zadevanje* or grasping the object and *predočevanje* or gaining information about the object. For example, in the experience of seeing a red thing, one can separate the *zadevanje* which apprehends the thing itself from the *predočevanje* which comprehends its property of redness.

Veber accordingly distinguished between phenomenological objecthood (*predmetnost*) and ontological thinghood (*stvarnost*) which he saw Meinong as having confounded. It is true that Meinong came close to distinguishing the two in his distinction between genuine presentations and fantasy presentations (i.e. ones involving and not involving belief). But Veber thought that Meinong confused phenomenological and ontological criteria in stating simply that genuine presentations are true, fantasy presentations false. For there are genuine presentations that are false, namely hallucinations.

Thus Veber felt compelled to go beyond Meinong's phenomenological object-theory and start doing ontology proper. In this he was followed by his pupils.

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SEPPO SAJAMA

Vienna Circle. See: Carnap, Rudolf; Reichenbach, Hans

Voluntarism

Voluntarism, as a pejorative term, means some exaggerated and distorted view of freedom, or a divorce of freedom from other factors and presuppositions; as a neutral term, it signifies an extraordinary emphasis on freedom. More precisely, we can distinguish:

1. Voluntarism as strong defence of freedom: In a loose and misleading usage, 'voluntarism' often refers to positions which simply insist on various true features of the will and of freedom or on the self-causing structure of willing in opposition to intellectualistic or deterministic positions which more or less radically deny the fact of freedom. In this sense, one speaks frequently of the 'voluntarism' of John Duns Scotus, opposing his thinking thereby to an intellectualism which makes the decisions of the will entirely dependent on cognition, or to other theories of the predetermination of our will.

2. Voluntarism as assertion of the superiority of freedom over the intellect and other faculties: Voluntarism can also have a purely hierarchical sense as seen in the famous medieval dispute over whether the intellect or the will is the higher rational faculty of the person. By insisting on the primacy of intellectual over moral virtues, Aristotle is usually called an intellectualist, while Duns Scotus by his insistence on the higher value of the will and of love is called a voluntarist.

3. Voluntarism as isolation, exaggeration, or distortion of freedom: Freedom can be absolutized or divorced from other faculties in many ways, which we shall deal with in what follows:

Regarding the human will, voluntarism can mean various types of artificial divorce of the will from other equally important factors which are required or presupposed by it. A radical voluntarism in this sense could be seen in Jean-Paul Sartre's denial both of the nature of man and of an intelligible or value-bearing nature of objects, so that the will becomes the origin of essence and order. In another sense, voluntarism is a position which denies the influence of social or other factors and insists on the pure formal structure of the will as basis of moral values. In this sense, Kant's ethics contains voluntaristic traits. A voluntaristic theology of the will such as that of Pelagius (*c.* 360–*c.* 420) would deny any direct influence of divine grace on the will.

Voluntarism in still another sense would divorce the will from any motive, arguing that motives impose some determination on the will which is incompatible with its spontaneity and self-determination (Kant and others). Seifert (1976, 1989) attempts to show that values, goods, and other factors which motivate the will do not threaten freedom but both render meaningful free action possible and can exert their specific influence on free action. This occurs not in the manner of natural determining causes; rather, goods and values become effective only 'through freedom', i.e. through the non-forced consent of the subject, who must allow himself to be motivated; thus they constitute unique kinds of causes which are irreducible to efficient causes in any meaningful sense of this term which refers to a power through the agency and force of which something happens (Aristotle and realists) or is conceived to happen (Kant, empiricists, and idealists).

Regarding the divine will, voluntarism in a historically most important sense can be attributed to William Ockham and to René Descartes in the form of the view that it is not the human but rather the divine will that is the sole origin of all order of essences and moral laws, so that even eternal verities could be changed by God's will. Thus according to Ockham, God could make hatred of him good by an act of the will and Descartes seems to come close to this position. Here a kind of theological ethical positivism is associated with voluntarism. J.-L. Marion (1981) sees the radical novelty in Cartesianism in the idea, expressed in Descartes's *Meditations* and letters to Mersenne, that the necessary principles and eternal truths could all be changed by the will of God and that they are creatable. This idea contradicts the absoluteness of essential necessities and gives rise to the famous circle in Descartes's argument for God's existence.

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JOSEF A. SEIFERT

W

Walter Burley

Walter Burley was born *c.* 1275, probably in Yorkshire, and was magister artium and fellow at Merton College, Oxford, by 1301. He studied theology by 1310 at the University of Paris where he attained magister theologiae by 1324. Burley may have returned to England, but he was again in France in 1327 as envoy to the papal court at Avignon. In the same year he held a disputation entitled "On the first and the last instant" at Toulouse. By 1333 he was back in England as one of the group of scholars gathered around Richard de Bury, held various benefices, and was also connected with the king's court as clerk of the royal household. In 1341 he held a disputation at Bologna. Burley died after 12 January 1344.

Burley's writings cover all the major areas of philosophy, including logic and theory of scientific demonstration, metaphysics, natural philosophy, psychology, ethics, and political theory. He is also well known for his *De vita et moribus philosophorum*. His philosophy shows influences from a variety of sources: Aristotle, Averroes, Aquinas, and John Duns Scotus. His younger contemporary, William Ockham, provided a challenge to several of his philosophical positions. However, Burley's own 'anti-Ockhamism' has been greatly exaggerated, at least until L. Baudry's influential article of 1934.

Burley has been characterized variously as an extreme realist, a moderate realist, a conceptualist, an Averroist, a Thomist, and a Scotist. There is some foundation for each label, but it is preferable to lay out his positions on basic ontological issues as they are presented in his texts, in particular in his major expositions and in his non-commentary treatise *De puritate artis logicae*, as well as his independent shorter compositions.

Burley is a vigorous defender of an extramental reality of universals. He argues:

> Even if no intellect existed, two stones would nevertheless agree more with one another than a stone and a donkey. But all agreement is in virtue of some one thing. Therefore there is some one common thing outside the soul [*aliqua res communis extra animam*] (*Super artem veterem*, Venice 1497, a4vB).

Of course, the universal is *not* an entity 'in addition to' particulars of which it is an essential constituent. For in reply to the objection that his position leads to an infinite regress Burley writes:

> It is not true that *a* and *b* agree in human nature as a third entity different from those two; rather, one of those is contained under the other, that is *a* and *b*, as an individual under a species. But *a* and *b* do not agree in virtue of some third species common to the two of them (op cit., a5vA).

Burley's idea of the basic relation among the ontological constituents of individuals is definitely not to be represented by '$R(F,a)$' but rather by '$F(a)$' where the exemplification of universal F by a 'shows itself', but is not referred to, in the object language. Moreover, he does not even suggest that universals ever exist as separate entities in the sense in which particulars exist. He definitely endorses what we might call the principles of exemplification,

$$(F)(\exists x)Fx \text{ and } \sim(\exists x)(F)\sim Fx,$$

i.e., every universal is instantiated and there are no bare or non-natured particulars.

Burley also recognizes what he calls *propositio in re* as the "ultimate and adequate significate" of spoken and mental propositions and he insists that this significate must not be confused with the mental proposition, for the latter is a sign, while *propositio in re* is not:

Such adequate and ultimate significate cannot be a sound or a concept. There must therefore be some 'complexum' or some proposition outside the soul [*aliquod complexum seu aliqua propositio extra animam*] which is composed out of things as from subject and predicate (*Super artem veterem*, c3vB).

In Burley's view, such a proposition is also needed to provide an ontological ground for the distinction between noun-phrases and statements:

For if the ultimate significate of 'a man is a stone' is nothing else than this man and stone, then it is the same to say 'man stone' as 'a man is a stone' and, as a consequence, just as this proposition is false 'a man is a stone', so also would the phrase 'man stone' have to be false (op. cit., c3vB).

Burley concludes that there must be a foundation for this difference in extramental reality:

There must be some 'composite' [*compositum*] in things whose subject is a thing, and its predicate is likewise a thing, and this is called *propositio in re* (op cit., c4rA).

Individuals are hylomorphic units composed of *this* matter and *this* form. We can know individuals directly, and this not only by a sensory, but also by an intellectual, cognition.

In natural philosophy, Burley argued against the actual existence of a vacuum:

The same agent which governs the nature and natural order in the universe saves the plenitude in the universe, for if there were a vacuum in some part of the universe, then another part requisite for perfection of the universe would be lacking and thus the universe would not be perfect (*Questiones super libros Physicorum* IV, q. 6).

This view was quite compatible with the prevalent rejection of action at a distance and with the insistence on a direct or indirect contact for causal transmission.

Burley's analysis of change in qualities of a body rejected the addition-of-part-to-part theory which stressed the continuity of qualities. His own theory involved an admission of infinite series of indivisible degrees, that is, a succession of forms, the preceding ones being replaced by new ones. Yet, this theory was not intended to be atomistic; it viewed alteration as continuous. Although there are infinitely many indivisible degrees in a continuum, not all parts exist actually but only potentially. Moreover, a continuum for Burley is not made up of indivisibles in the way in which a whole is made out of its integral parts, for a continuum is 'more' than the sum of its parts in the sense that it is extended while the indivisibles are not.

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IVAN BOH

Whitehead, Alfred North

Alfred North Whitehead was a mathematician and philosopher who produced a system of process metaphysics (i.e. a metaphysics which treats becoming and being as equally fundamental).

Born in Ramsgate, Kent, in 1861, Whitehead was educated at Trinity College, Cambridge. In his career as a mathematician at the Universities of Cambridge and London, Whitehead's most important student was Bertrand Russell, with whom he collaborated in writing *Principia Mathematica* (1910–13), an attempt to show that mathematics can be reduced to logic. Although he had an interest in philosophical questions at least as early as his election in 1884 to an élite conversation club at Cambridge, his first philosophical books were published only in 1917–20. These

essays in the philosophy of science prefigured his metaphysical works and led in 1924 to his appointment in philosophy at Harvard, where he taught until 1937. He died in Cambridge, Massachusetts, in 1947.

In *Science and the Modern World* (1925), his first metaphysical work, Whitehead rejected the idea of *simple location* presupposed by scientific materialism. Everything, he held, is a field spread out temporally and spatially; there are no discrete bits of matter externally related across empty space and time; every object, from a truck to an atom, is composed of events or processes. When the structure of events or processes recurs in subsequent events or processes, we recognize a 'thing'.

This view of reality as fields of energy and vibratory processes was received with excitement. Seldom has a metaphysical work had such an immediate impact in the arts and sciences; it remains among the most widely read 20th-century philosophical works in English.

In *Process and Reality* (1929; corrected edition, 1978) Whitehead systematically and technically elaborated the metaphysics he had sketched so persuasively in the earlier work. In this book Whitehead exhibits extraordinary powers of imagination as much as of formal analysis. Some understanding of Whitehead's system can be achieved by first noting what he considers the most basic metaphysical unit, an *actual entity*. Although an actual entity is a microscopic atom, it is not an inert bit of stuff; it becomes and perishes without substance underlying the process of becoming. *Concrescence* is the process by which an actual entity comes into being. An actual entity is a unifying of its relations to the other actual entities of the world it appropriates. These appropriating relations are *prehensions*, vectors which transform everything experienced into that entity's distinctive actuality. A concrescing entity involves not only other actual entities it prehends but also non-actual *eternal objects*, potentialities, or possibilities, which contribute to the character of that entity. A remarkable feature of Whitehead's metaphysics is that *all* actual entities and eternal objects play a role (at least negatively) in the becoming of each actual entity.

God also plays a central role in concrescence. In his *Primordial Nature* God orders eternal objects to make them relevant to the becoming of an entity; he gives each concrescence its initial *subjective aim* or *lure* from which its self-causation starts. Furthermore, in his *Consequent Nature*, God preserves the immediacies of all past actual entities and unites them with his envisionment of the primordial reality of all eternal objects. God, then, is himself an ever-developing unity, an actual entity prehended in every concrescent process and thereby influential in every becoming. God is not only necessary to every becoming; becomings are necessary to the development of God as Consequent. Like any actual entity, God is a process of becoming.

Although the actual entity is Whitehead's basic metaphysical unit, he does not neglect the world of chairs, buildings, persons, etc. He has a complex theory of the operation in which an aggregate of actual entities forms an ordinary, macroscopic object.

A distinctive theory of perception is also integral to Whitehead's metaphysics. As he sees it, the preoccupation of David Hume and other philosophers with *perception in the mode of presentational immediacy* has led to serious metaphysical as well as epistemological problems. For Whitehead, ordinary conscious perception is in the *mixed mode of symbolic reference*, a combination of two more primitive modes of perception: presentational immediacy and *perception in the mode of causal efficacy*. The latter is the vague, massive, and inarticulate perception of the early phases of concrescence. The former belongs to the later phases of concrescence; while less massive and powerful, it is more articulate and sharp than perception in the mode of causal efficacy. It is because presentational immediacy dominates visual perception that Hume finds no grounds for supposing that causality is real. Whitehead argues that his more adequate theory of perception permits a metaphysics in which causal powers are fundamental realities.

Whitehead's metaphysics is considered by many to be the most fully elaborated theory in which substance (as traditionally conceived in Western philosophy) is rejected and

process is seen as fundamental. Although such Continental philosophers as Hegel and Henri Bergson (and some non-Western thinkers) are often considered process metaphysicians, the process viewpoint appears to be especially congenial to philosophers in the United States. Charles Sanders Peirce, William James, John Dewey (1859–1952), and George Herbert Mead (1863–1931), are among the American process metaphysicians of the past. In the present Charles Hartshorne (born 1897) and Justus Buchler (born 1914) are leading figures.

Whitehead has further significance in 20th-century metaphysics because, during the many decades in which analytic philosophy was dominant in the English-speaking world, Whitehead's was the only comprehensive system of speculative metaphysics continuously studied by a wide range of competent philosophers. In the analytic climate it was perhaps natural for Whitehead to command respect since he was a pioneer in symbolic logic and a distinguished physicist who worked out a theory of relativity as an alternative to Albert Einstein's.

Whitehead's influence has been too varied and extensive to be easily summarized. His rejection of simple location, for example, has stimulated poets. His theory of God has spawned (with the aid of Hartshorne and others) process theology, a religious perspective that plays a major cultural role today. His work in physics and its metaphysical assumptions is given serious attention by Nobel Laureate Ilya Prigogine (born 1917) and other distinguished scientists.

Works have applied Whitehead's metaphysics to aesthetics, ethics, social philosophy, and many non-philosophical fields. Within the field of metaphysics itself his work has also been a powerful stimulant. Although Hartshorne was a process philosopher before becoming a student of Whitehead at Harvard, he acknowledges Whitehead's pervasive influence. Some metaphysicians influenced by Whitehead (e.g. J. Buchler) have developed their ideas partly by way of a critique of Whitehead.

In the post-analytic era Whitehead's work can be expected to continue to stimulate both exegesis and original metaphysical enquiry, perhaps increasingly as more philosophers become engaged in constructing comprehensive systems that take account of recent work in logic and the sciences.

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PETER H. HARE

The Will

While will in a wider sense can be ascribed to animals and even to lower creatures in which some tending towards ends is observed, in the strict sense it can be ascribed only to persons, whether these be men or pure spirits. Will in the strict sense implies not mere irrational tendencies or drives but rational action, or at least the capacity for this. Moreover, will, unlike feeling, desire, or drive, presupposes that its subject is free (even though one might admit that some things, for example happiness or a positive 'good' in the widest sense of this term, are willed by necessity).

History. The topic of free will appears in many forms in the Presocratics, in Socrates and in Plato, and it plays a dominant role in the work of the Stoics. Aristotle distinguishes many senses of free and unfree act in the *Nicomachean Ethics* (Book III) and formulates two fundamental requirements of an act that is morally free: knowledge on the part of the agent of the object of the act and of its immediate consequences; and the givenness of the act into man's power to such an extent that 'we are lords over its being or non-

being'. Stoic philosophers, in particular Epictetus (*c.* 50–120), made it a fundamental point of their philosophy to distinguish between that which lies within our power and that which does not lie within it, recommending that we do not take great care in, or grieve over, things which are not ours to change. Ancient philosophers' insistence on freedom culminates in Cicero (106–43 BC) who, through his influence on Augustine, also stands at the point of transition between the ancient and the medieval philosophy of freedom.

Under the influence of Christianity, the importance of the theme of freedom became much heightened in medieval thought. Christian philosophers were forced to examine the issue of freedom more closely than the Ancients had ever done. For neither God's creation of the world, nor sin, redemption, justification, damnation, and the origin of evil, can be understood without appeal to the notion of freedom. At the same time, however, as we shall see, divine foreknowledge and the effectiveness of grace, as well as the doctrine of creation, posed new problems for a philosophy of freedom and led frequently to deterministic theories. This does not alter the fact that the issue of freedom takes on a greater weight in Christianity, particularly in Catholicism, than in earlier philosophies, as a reflection of the need to justify the thesis that it is man, and not God or fate, that is the cause of sin – a position which presupposes human freedom. The most important positive philosophical contributions in this area include distinctions between various senses of necessity, the discovery of two fundamentally opposed motives of the will (Augustine's 'two loves' which separate the 'two cities', Anselm's *bonum honestum* and *bonum utile*), the discovery of the metaphysically ultimate character of freedom even in relationship to an omnipotent Creator (John Duns Scotus, William Ockham), the idea of co-operation between man and God in the free act, as well as a new insistence on the dependence of man's ultimate value and fate on his free choice.

The two-edged influence of Christianity on the philosophy of freedom from Augustine onwards led both to many new positive accounts of freedom, and at times also to a denial of freedom in favour of predestination and divine foreknowledge. Such a denial is found, of course, also in many Islamic and ancient philosophies. It appears, indeed, to follow from assuming God, and for this reason a great number of champions of freedom, from Carneades or Epicurus, through Kant to Sartre, were atheists or agnostics. Nevertheless, as we shall see, many new observations and distinctions regarding freedom were introduced by the encounter between philosophy of freedom and Christian dogma.

In modern and contemporary philosophy free will is partly radicalized in various senses of 'voluntarism', and partly rejected in determinist philosophies which arose particularly from materialist interpretations of scientific theories of causality, of the brain, and of evolution. Freedom and will are treated by modern philosophers in many senses and contexts: as bearer of moral value (Kant and many others); as source of errors when the judgement asserts more than is rationally justified (Roger Bacon, René Descartes); politically, as general will of the people (Jean-Jacques Rousseau); as object of a human right e.g. to freedom of expression; or as both the source and end of society and history (Hegel). Some modern theists and atheists, for example Friedrich Nietzsche and Søren Kierkegaard (1813–55), speak of the drama of freedom chiefly in relationship to God. According to Nietzsche, the murdering of God, with its consequent *Umwertung aller Werte*, is the supreme act of the will to power. According to Kierkegaard, the authentic self of man is constituted by the proper relationship to the absolute source of his being, while the improper relationship leads to despair which Kierkegaard analyses in its phenomenological and metaphysical aspects in *Sickness unto Death*. Three general aspects characterize the philosophy of free will in the modern discussion:

1. The soul or the person as 'individual substance of rational nature' (so defined by Boethius and Aquinas) is denied. Freedom and will are defended, then, without a proper ontological subject.

There are only free-floating experiences or acts without a self, or there is a 'transcendental ego' or an act-centre without clear ontological status, or there are national or world-spirits of dubious nature which become the new 'subject' of willing. After Descartes the soul and person as subject of volition is often denied. In fact, Nietzsche states that the whole of modern philosophy tries to show, *against* Descartes and Christianity, that the subject is a product of a conscious activity, not its ontological ground.

2. The free will is increasingly divorced from any pre-given and objective order, from essences, natural rights, objective values, etc. It becomes an absolute source even of the *a priori* (especially in Johann Gottlieb Fichte). Human will is interpreted, by Sartre, explicitly along the lines of Descartes's voluntaristic vision of God's will: a will that creates truths.
3. The phenomenology, psychology, description, or linguistic analysis of will and freedom, etc. become more important than a metaphysics of freedom itself.

Different Meanings of 'Will'. Turning from a historical to a systematic philosophical consideration, the will presents itself from many perspectives. Thus it can be investigated as an act which occurs at a concrete point in time. 'Willing' in this sense can still signify very different sorts of acts: purely interior acts of will, such as approving of someone's action or speech, accepting suffering or revolting against it, or voluntary wishes; speech acts (social acts) such as promising which are not the mere expression of an act of willing but need to be heard by their addressee (Adolf Reinach); and finally actions which aim directly at the realization of states of affairs in the external world, such as saving a life. Willing as it underlies external action can again be different things: it can have an individual object or relate to a general sphere of goods or obligations; it can be the willing of the state of affairs at the realization of which the action aims (*finis operis*); or it can refer to subjective secondary purposes, non-essentially linked to the action, such as becoming famous through saving a life (*finis operantis*); or again it can refer to the *Gesinnung*, the moral intention from which the willing springs, that is to the will as it relates to its most fundamental motives. Moreover, objects of actions can be willed in different ways: some we will as ends, others as mere means, still others as ends and simultaneously as means towards further ends, etc. Dietrich von Hildebrand also distinguishes two perfections of the free will: that which is involved in the *responding* to an object, and that which is involved in the free *commanding and initiating* of activities and actions.

The 'will' can also, however, designate the lasting faculty of the person to will (analogous to the intellect). Furthermore, it can be understood as an enduring disposition to act, as illustrated in the 'ability' of the flute-player to perform his art. Or it refers to stances towards individual persons and objects, or attitudes with response-character to whole spheres of goods, attitudes which endure in the person and are not restricted to a certain point in time. Such attitudes can have different levels of depth in the person, reaching from the fundamental affirmation or rejection of the world of goods, or from the indifference towards all objective values, to attitudes towards specific goods such as truth, possession, rights, etc. Different fundamental moral attitudes and specific virtues and vices result from the responses to such specific spheres of goods. In Anglo-Saxon philosophy, Peter Geach and Alasdair MacIntyre have, through their rediscovery of virtue, made a major contribution towards a well-rounded vision of freedom. In German philosophy, Max Scheler (1874–1928) and Dietrich von Hildebrand – the latter through his new understanding of 'fundamental attitudes' which exist as lasting and general value-responses in the person and form his actual experience, as well as through his interpretation of virtues not as mere dispositions to act but as attitudes in their own right – may have made the most significant recent contribution towards a classification of different senses and dimensions of the will.

They broke through the one-sided Kantian emphasis on external free actions and yet preserved the experienced givenness and unity of the various levels of will, by seeing the external action as a logical and essential expression of general attitudes, where other authors (for example K. Rahner, C. Curran, F. Böckle) conceive the 'fundamental option' of the person as a 'transcendental' sphere largely disconnected from concrete actions which would have to be interpreted in terms of a balance of their good and bad consequences.

Freedom, Conscious Subjects and Causal Determination. Another problem is whether there exists only a psychological feeling or subjective experience of freedom – as admitted by some proponents of 'soft determinism' – or whether objective freedom is a fundamental trait of the person and of his faculty of the will.

Freedom, in its strong sense, consists in a unique spontaneity and power over one's action, as well as in self-motion (in an ultimate sense which any determinism – hard or soft – denies). As was emphasized already by Hesiod (8th century BC), it involves some independence of lawfulness and morality from natural causality and force. Thus it implies also an independence of morality and of the legal order from that of physics. Involved in this is also some autonomy of the self (soul) in regard to matter and material causes as well as in regard to all other extrinsic causes such as predestination or fate. Thus by his freedom, as the Platonic myth of Er (*Rep.* X, 617 e 1f.) states, man holds in his hands the key to his own being and fate.

Prejudice has it that ancient philosophy never recognized the ultimate metaphysical fact and the ultimate nature of freedom, speaking of it only on a political or ethical-psychological level. Yet we find hardly a stronger statement of the full metaphysical freedom of action than in the *Eudemian Ethics* (1223a), where Aristotle asserts that man "is the lord over the existence or non-existence (of his actions)". Here Aristotle states that man is the ultimate origin and cause of his own acts and has power over them. Cicero is possibly even clearer on freedom in his thesis that it is evident that man is an absolute origin of his free action and that this is the necessary condition of the entire moral and legal order. In this respect, thinkers, such as Augustine (in *De libero arbitrio* and in *De Civit. Dei* V), Bonaventure, Descartes, and Jean-Paul Sartre were hardly more outspoken.

From Plato's *Phaedo* on, knowledge, in particular the knowledge of justice, and the will to obey justice were seen as evidence for the existence of the soul; for without soul or spirit, man's actions must be completely subject to material forces and determinations. A long tradition which culminates in Augustine links the existence of the soul to freedom (Hölscher 1986). And indeed, how can man be free and determine himself, dominate himself, and achieve his proper virtue, if he is nothing but his brain or some matter subject to the laws of natural causality?

The free encounter with morally relevant goods is also the condition of moral responsibility. It is evident – and many moral philosophers have agreed on this – that without freedom neither praise nor blame, neither guilt nor merit, neither moral values nor moral disvalues are possible. Thus ethics is largely a matter of a philosophy of freedom. Yet in ethics not only the metaphysical fact of freedom but many different aspects of freedom play a decisive role.

An act of will necessarily presupposes consciousness and some knowledge of its object. This is hardly controversial except among strict materialists or behaviourists. Controversy arises, however, over whether the known good determines or motivates the will in such a way that no free choice is possible. No man does injustice knowingly, says Socrates. And Aristotle assumes that happiness is necessarily the end of the will. As far as the relationship between knowledge and freedom is concerned, the Socratic thesis implies that knowledge is not only a condition of free acts but their sufficient reason. While Aristotle and many other authors contradicted such an 'epistemological determinism', this very same position follows from their general assumptions; for if we must strive for happiness by necessity, then we must choose

the best means towards this end; but then intellectual necessity dominates the will.

To overcome this problem it was necessary to distinguish among various sources of evil and of value blindness as well as among different sorts of motives for action. Moreover, where Aristotle and a long tradition had held that the final end of the will is happiness and is willed by necessity, some authors argued that there are different categories of importance, or motivating factors of the will, which are utterly distinct from each other and are not reducible to 'happiness'. Augustine with his 'two loves', Kant with his 'acting from duty' and 'acting from inclination', and Hildebrand's distinction of three categories of importance (*Ethics*, 1978) are among the most noteworthy contributions here. If Augustine, Kant, and Hildebrand are correct, then the will chooses not only between means to reach happiness; it can choose between ultimate ends, also, and this fact is the condition of moral evil. Among the Thomists, Cornelio Fabro (1983) came closest to recognizing this. The ethical distinction between moral goodness and moral evil presupposes that the free choice refers not only to the means but also to the ultimate directions of one's life. Thus, for example, we can choose to live in accordance with the truth and with all objective goods which demand our due response – or we can choose an egocentric life of pleasure or self-love, leading a life marked by indifference towards intrinsic goods, or even by hostility towards them.

Freedom, Fate, and Theodicy. As we have already seen in the sketch of the history of the philosophy of freedom, the issue of the relationship of freedom to God and foreknowledge is a crucial one. Probably chiefly with reference to the indeterminacy of free acts of will, Aristotle denies in *De Interpretatione* that truth can exist about future contingents. Cicero goes as far as to say that all divine foreknowledge of free acts contradicts their existence as free acts. If God foreknows free acts, they will happen necessarily as he foresees them and, therefore, cannot be free. Since we know that we are free, and since this is the basis of all moral and social life, we must reject divine foreknowledge. Regarding this, Augustine has made the most remarkable contribution by distinguishing three senses of necessity (*De libero arbitrio*), only one of which is incompatible with freedom:

1. There is, first, the necessity that each action, if it is now, is necessarily as it is now; and if it will be, will necessarily have to be in the future. This necessity – which flows from the principle of identity – applies evidently also to freedom and does not contradict it; on the contrary, because free acts must be identical with themselves, they must precisely be free and cannot be unfree.
2. There is, second, the necessity that all future actions, if they are known, will have to be as they are known. This necessity follows from the combination of the principle of identity and of the nature of knowledge. But neither knowledge nor the principle of identity imposes a necessity on actions which would contradict their freedom. We can see this with respect to past free acts: these must necessarily correspond to our correct memory, but they do not cease thereby to have been free.
3. Only a third kind of necessity, that of some force outside the subject (e.g. the brain) causing and determining the content of his acts, would destroy freedom. But this necessity does not follow from divine foreknowledge, as Augustine points out.
4. A fourth sense of necessity, which Augustine uses as comparison, would destroy freedom: the necessary unchangeability of past events (Seifert 1989). If the future were not objectively open to different possibilities, but were necessarily fixed as are our past free actions, our future acts could not be free and freedom would be an illusion. For freedom demands a true potentiality and possibility of a sort that will not be realized wihout the subject and that can be actualized in different ways. Yet nothing proves that future acts are fixed in such a way that they lack the possibility of being otherwise (as past acts

are). In fact, freedom is not merely possible but evidently exists in man. Therefore the openness and non-necessity of the future must exist also.

But how, then, is foreknowledge of free acts possible? Augustine, Descartes, Kierkegaard, and others defend the evident fact of freedom; they insist that, in spite of the incomprehensible mysteriousness of foreknowing free and future acts, in some way the existence of our freedom – which is evident – and God's eternal foreknowledge – the existence of which we know through well-grounded faith and through rational logical demonstrations – must be compatible with each other.

The question of free will also touches that of the origin of evil and of theodicy (of the 'defence' of God against the charge of causing evils). Freedom both solves and poses the problem of theodicy. On the one hand, only the freedom of creatures can possibly 'free God from the charge of causing an evil world'; thus only the freedom of finite persons can lead us out of the dilemma of theodicy. On the other hand, God's freedom *and* omnipotence is the cause of the problem of theodicy. For how can a free and omnipotent being, which has the power to prevent evils, fail to do so? Interestingly enough, the freedom of finite persons provides an indispensable key also to the answer to this question; for only if created freedom calls for some kind of absolute respect – even when it wills or causes evils – can the problem of theodicy possibly find a solution.

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JOSEF A. SEIFERT

William Ockham

Life. Born before 1290, probably in the village of Ockham near London, William Ockham entered the Franciscan Order at an early age. While many details of his career remain unclear, Ockham is known to have been ordained subdeacon of Southwark on 26 February 1306 and licensed to hear confessions on 19 June 1318. He studied at Oxford (probably from 1309), lectured on the *Sentences* of Peter Lombard (*c.* 1100–*c.* 1160) between 1317 and 1319, and thus attained the rank of *baccalaureus formatus*. Brilliant but controversial, Ockham's academic career was cut short in 1323, when John Lutterell, one-time chancellor of Oxford University, delivered to Pope John XXII a list of fifty-six allegedly heretical theses extracted from Ockham's writings. After two years of study, a papal commission found fifty-one propositions open to censure, but none was formally condemned. While in Avignon to answer these charges, Ockham became embroiled in the controversy over Franciscan poverty, eventually accusing John XXII of contradicting the Gospels and earlier papal decrees and hence of being no true pope. Having committed these allegations to writing, Ockham fled with Michael of Cesena then minister general of the order, first to Pisa where he was offered protection by Emperor Ludwig of Bavaria, and ultimately to Munich, where he lived until his death (according to his epitaph, on 10 April 1347).

Works. While the exact chronological order of Ockham's works is not known, partly because many were composed during the same short period, the following groupings are clear (volume references are to the critical edition, *Opera Philosophica et Theologica*).

1. 1317–19: *Reportatio* (Books II–IV of his *Sentence* commentary; OTh V–VII);
2. 1321–3: *Expositio aurea* (OPh II), *Expositio super Elenchorum* (OPh III), *Expositio super Perihermenias* (OPh II), *Expositio in libros Physicorum* (Books I–IV; OPh III–IV); *Ordinatio* (Book I of *Sentence* commentary, revised);

3. before 1324: *Summa logicae* (OPh I), *Tractatus de praedestinatione et de praescientiae Dei et de futuris contingentibus* (OPh II); *Expositio in libros Physicorum*, Books V–VII (OPh V); and *Quodlibeta* (OTh IX);
4. after 1324: various political writings.

Method. Ockham's fullest statements of the famous Razor – "*Nulla pluralitas est ponenda nisi per rationem vel experientiam vel auctoritatem illius, qui non potest falli nec errare, potest convinci*" – combine a methodological bias towards parsimony with a recognition of three norms – reason, experience, and infallible authority – to which human theory-making must answer. (The common version, "*Entia non sunt multiplicanda praeter necessitatem*" is not to be found in Ockham's works.) Neither invented by Ockham (versions are to be found in Aristotle) nor chosen as his favourite weapon in metaphysical disputes (he preferred the more powerful Principle of Non-Contradiction), the Razor nevertheless summarizes the spirit of his philosophical conclusions. Ockham shared with other late medieval giants (notably Thomas Aquinas and John Duns Scotus) the aim of a philosophical theology that was both Christian and Aristotelian. Although departures from his eminent predecessors combined with ecclesiastical difficulties to make Ockham unjustly notorious, his thought remains, by modern lights, philosophically and theologically conservative.

The Problem of Universals. In rejecting the doctrine that universals are real things other than names as "the worst error of philosophy", Ockham fancies himself the true interpreter of Aristotle. Platonism was not a live option; neither did Aristotle mean to affirm, strictly speaking, that human nature is *in* Socrates, as if a human being were a composite of a human nature and individuating principles. After repeatedly reducing to contradiction the central 'moderate realist' idea – that the nature of itself is indifferent to universality and particularity, but has a double mode of existence, so that it can be universal in one and particular in the other – Ockham insists that everything real is individual and particular; universality pertains only to names and that by virtue of their signification relation. For Ockham the primary names are naturally significant concepts that signify many indifferently by suitable resemblance relations, whereas conventionally significant spoken and written words are imposed to signify what the corresponding concepts signify. Thus, his theory of universals is best classified as a form of conceptualism. In early writings, Ockham distinguished between the really existent mental act and its objectively existent objects, and identified concepts with the latter; later, he abandoned the distinction between real and objective *esse* and held that concepts were really existent mental acts.

Hylomorphism. Rejecting atomism, Ockham defends Aristotelian hylomorphism in physics and metaphysics, and endorses the Aristotelian partition of forms into substantial and accidental. Ockham's unparsimonious opponents, the 'Moderns', posited a really distinct kind of form for each of Aristotle's ten categories and assigned material things a layer-like structure: prime matter forms the core, which unites with inherent substantial form to make something one *per se*; the first accident to modify substance is quantity; corporeal qualities then inhere in quantity as proximate and substance as remote subject; and quantity gives extension to both its substance-subject and the qualities of which it is the subject. Substance, quantity, and quality are absolute things which serve as foundations for really distinct relative things (*res relativae*) or respects (*respectus*) corresponding to the seven remaining accidental categories; the latter inhere in the former. Ockham argues against this elaborate picture. When he restricts accidents really distinct from substance to certain species of quality, he takes himself to be expounding the true interpretation of the Philosopher. Ockham rejects the inferences "there are no quantitative or relative forms really distinct from substantial or qualitative forms; therefore, it is an arbitrary or subjective matter whether things are quantified or related" and "only names are universals; therefore it is an arbitrary or subjective matter which things are co-generic or co-specific". On the contrary, one of his

central contentions is that a complete description of reality, of things as they are prior to and independently of any human intellectual activity or choice, will not consist merely of a list of which things (*res*) there are, but also will involve consideration of how they are. Prior to and independently of any intellectual activity of choice, things really exist somehow and not otherwise.

Ockham's own development of hylomorphism is distinctive in several ways.

1. Following the Franciscan School, Ockham recognizes in living things a plurality of substantial forms (on his version, prime matter, corporeity, and sensory soul in a donkey; prime matter, corporeity, sensory soul, and intellectual soul in a human) which have a primitive aptitude to unite with prime matter and with each other to make something one *per se*.
2. Where Aquinas had seen a distinction of reason between prime matter and substantial form, and Duns Scotus had posited a real distinction between matter and form but only a formal distinction between sensory and intellectual souls in humans, Ockham insists on real distinctions among them all.
3. Having denied the existence of quantitative forms, really distinct from substance and qualities, Ockham recognizes two differences between corporeal and spiritual substances: (a) corporeal substances include matter as well as substantial form, and (b) spiritual forms (God, angels, the intellectual soul, spiritual qualities) are simple, but corporeal things (including their matter, substantial forms, and accidents) are each, by their very nature and apart from everything else, distinguished into parts, which are extended or not depending upon whether some efficient cause moves them in such a way that one part is at a distance from another. Thus, both corporeal substances and their metaphysical constituents and accidents are essentially composite; but because such parts do not essentially exclude one another from place (in the way really distinct quantitative forms were supposed to do), it follows that many can exist in the same place at once naturally (in condensation) and all by divine power. Accordingly, corporeal things can exist without being extended, as the body of Christ does in the sacrament of the altar.

Causality. Given regular correlations in nature, Aristotle posited substance- and accident-things as primitive explanatory entities which essentially are or give rise to the powers (*virtus*) that lie behind the regularities. For Ockham, the power (*virtus*) responsible for such regularities may be internal or external to the things correlated. Only where it is *A*'s own power (*virtus*) that explains the correlation between *A*'s and *B*'s, do we have a case of genuine efficient causality; where the power (*virtus*) lies in the will of another (as, e.g., when the divine will causes the infusion of grace to be correlated with the celebration of the sacraments) *A*'s are said to be causes of *B*'s *sine quibus non*. Nevertheless, Ockham denies the existence of any *sine qua non* causes in nature. Moreover, he believes that created natures are as they are and are possible in and of themselves and hence independently of their relation to anything else, God included. Since for Ockham created substance- and accident-things are essentially the power (*virtus*) to produce a given range of effects, it follows that not even God can change the natural causal powers of creatures (so that, e.g., heat is naturally a coolant or the power to produce whiteness, or that corn kernels naturally produce horses). But just as many 'Aristotelian' productive powers are naturally obstructible on occasion, so all are by divine intervention. Ockham endorses the uniformity of nature principle, his denial of real universals notwithstanding, because he holds that individual natures are powers (*virtus*) and co-specific things are maximally similar. He invokes a number of other *a priori* causal principles as well: "Everything that is in motion is moved by something", "Being cannot come from non-being", "Whatever is produced by something is really conserved by something as long as it exists". Moreover, the

determination of created causes and effects to one another gives rise to a kind of *necessary* connection between them: although God could act alone to produce any created effect, a given created effect *could* not have had another created cause of the same species instead. Ockham's major innovation lies in his rejection of Scotus's 'essential order' and insistence that every genuine efficient cause is an immediate cause of its effects.

Theory of Knowledge. In epistemology, Ockham is an Aristotelian reliabilist, assuming as he does that human cognitive faculties (the senses and intellect) work always or for the most part. Ockham reasons from the premiss that we have certain knowledge of mind-independent material things and of our own present mental acts, and traces the source of such evident judgements to a distinctive species of acts of awareness, intuitive cognitions, which are the power to produce evident judgements regarding their objects. Ockham takes for granted the disruption of human cognition by created obstacles (as in sensory illusion), and *a fortiori* the divine power to intervene in numerous ways. Ockham draws no sceptical consequences from this concession, because for him certainty is freedom from actual doubt and error, not from the logical, metaphysical, or natural possibility of error.

Freedom of the Will. Like Scotus, Ockham regards the will as a self-determining power for opposites. Contrary to Scotus, Ockham applies causal models in action theory, insisting that

1. unfree acts of will may be necessitated, whether by the agent's own nature, by its other acts, or by an external cause, and that
2. free acts may include among their efficient causes not only the agent's intellectual and sensory acts but also its will.

Ockham refuses, however, to allow the innate tendencies in the will – e.g., the inclination to seek sensory pleasure and avoid pain; the *affectio commodi*, or tendency to seek its own advantage; and the *affectio iustitiae*, or inclination to love things because of their own intrinsic value – to limit the will's scope. Scotus had denied that inclinations to good were necessitating, in granting the will freedom to act or not in relation to any option – with respect to real or apparent goods, either to will (*velle*) them or not to act; with respect to evils, either to will-against (*nolle*) them or not to act; but not to will evil under the aspect and/or for the sake of evil, and not to will-against the good in general, happiness, or God. Ockham goes further, assigning the will, created and divine, the liberty of indifference or contingency – the power with respect to any option to will for it, to will-against it, or not to act at all. Ockham concludes that the will can will-against the good – by hating God; by willing-against its own happiness, the good in general, or the enjoyment of a clear vision of God; or by willing-against its ultimate end, whether ignorantly or perversely. Similarly, the will can will evils – the opposite of what right reason dictates; unjust deeds *qua* unjust, dishonest, and contrary to right reason; and evil under the aspect of evil.

Morals, Broad Sense and Narrow. Ockham observes the traditional division of moral science, the study of 'mores that are within our power', into two parts:

1. non-positive morality or ethics, which directs human acts apart from the precepts of a superior or of some authority, but instead draws its precepts from reason and experience; and
2. positive moral science that "contains divine and human laws which oblige one to pursue or avoid those things that are neither good nor evil except because they are prohibited or commanded by a superior to whom it belongs to make [*statuere*] laws" and includes both the science of jurisprudence (which studies contingent human laws) and sacramental theology (which deals with actual divine precepts).

Ethics. Ockham's 'Modified Right Reason Theory' of ethics begins with the Aristotelian ideal of rational self-government, according to which morally virtuous action involves the agent's free co-ordination of choice with right

reason. Each agent is obliged to make his own value judgements; neither acts done mindlessly nor in slavish obedience to authority are candidates for virtue. Invincible ignorance excuses; culpable ignorance doubles the offence; for if mistaken judgement is followed, there is the added offence of misdeed; if flaunted, contempt for conscience. Moral virtues come in degrees, based on the extent of agent-conformity to right reason. On this scheme, conformity to external authority could be moral only if it were dictated by right reason. Given suitable information, Ockham believes, this turns out to be the case. For unaided natural reason can demonstrate the existence of a nature than which there is none nobler and better, and right reason would dictate that such a being ought to be loved in the highest degree and negatively that no one should be led to do anything contrary to the precept of his God. Enlightened by revelation as to the unity, personality, and commands of this being, right reason would dictate the expression of love for this being in the effort to please him in every way. Thus, when theologically informed, right reason, the primary norm in non-positive morality, necessarily gives rise to the derivative norm of divine commands. Ockham's doctrine of divine liberty of contingency opens up the logical possibility of conflict between the primary norm and its derivative – e.g., if God should command humans to flaunt right reason. In such a case, right reason would reduce itself to an absurdity by generating contradictory precepts, and non-positive morality would break down. Ockham worried about such logical possibilities no more in ethics than in epistemology, however, given infallible, revelation that God commands rational creatures to follow the right reason.

Merit and Demerit. Following Scotus and against Peter Aureoli and John Lutterell, Ockham regards the category of merit and demerit as a branch of positive morality, dependent as these properties are on free and contingent divine statutes relating rational creatures to eternal destinies. According to Ockham, God is a debtor to no one, and so is under no requirement

1. to assign eternal destinies to creatures,
2. to distribute eternal happiness and eternal damnation on the basis of created free choices instead of, say, race, gender, or national origin, or
3. to accept morally virtuous acts and reject morally vicious ones;

nor was he bound in his distribution scheme either

4. to link merit and demerit to the present sacramental system of the Church,
5. to conform his distribution scheme to the Razor, or
6. to connect either with the infusion of theological virtues.

Advancing this doctrine – that obligation-free divine will is the primary norm in soteriology (= the doctrine of salvation) – as the strongest possible antidote to Pelagianism, Ockham insists that existing divine statutes make right reason a derivative norm in soteriology. So while it is logically possible that acts now labelled 'adultery', 'fornication', 'theft', and even 'hatred of God' should be commanded and hence done meritoriously, the twin norms of right reason and divine commands function harmoniously to govern both ethics and soteriology (albeit in reversed orders of priority).

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MARILYN MCCORD ADAMS

Williams, D. C.

Donald Williams was born into a ranching family at Crow's Landing, in the Central Valley of California, on 28 May 1899, and throughout a long career in academic philosophy in the USA he retained a naturalistic approach to metaphysics and epistemology, and conservative moral and political values, characteristic of his origins.

After studies in English literature, Williams went to Harvard and graduated AM in philosophy in 1924. He spent 1925–7 as a Ph.D. candidate at the University of California, Berkeley, before transferring to Harvard, where he took his doctorate in 1928. Following his marriage to Miss Katherine Adams and a year in Europe, he was at the University of California, Los Angeles, until 1939. He was to spend the remainder of his career in the Harvard philosophy department. Williams retired in 1967 and died in California on 16 January 1983.

He is an important figure in the history of 20th-century philosophy because he sustained the classical vision of philosophy, with a genuine programme in metaphysics and systematic epistemology, during a period when pragmatism, positivism, and linguistic philosophy had made the traditional conception of philosophy very unfashionable. Through more than fifty articles and books, he expounded an unevasive realism: naturalist, materialist, and anti-sceptical. He presented novel inductive arguments for the reality of the external world, and defended a representative realist theory of perception. He offered materialist conceptions of consciousness and of the secondary qualities. He accepted the obligation to locate meaning and value within a materialist metaphysical scheme, and made suggestions as to how this might be done.

Williams made important contributions to the philosophy of time. In "The myth of passage" he presented with great clarity and force, yet without technicalities, the case for adopting a Minkowski-style four-dimensional view of nature, abandoning the image of time's flow in favour of the equal, timeless, reality of all times.

In analytic ontology, Williams showed how the conception of Aristotle and of G. F. Stout, that qualities occur as *particulars* in their instances, could be developed into a powerful and elegant philosophy. Instantiated properties, abstract particulars or *tropes*, became the fundamentals in his system. Familiar objects are sums of compresent tropes (both monadic and relational). In place of universals are sets of resembling, non-compresent tropes. The tropes, the 'Alphabet of Being', prove, singly or in clusters, to be the real terms in all causation, the central objects of all evaluation, the basic subject matter of all perception and judgement. All reality consists in recurring patterns of these particularized qualities and relations.

Williams's work on the problem of induction was also integral to his defence of a non-sceptical metaphysical realism. In *The Problem of Induction* Williams revived the classic solution which derives from Jacques Bernoulli (1654–1705) and Pierre Simon de Laplace (1749–1827). It can be shown that the great majority of large samples from a given population are *representative* – that is, match the overall population in the proportions of the various characteristics present. In inductive inference we take a sample by observing some of the members of a certain population. It is very probable that our sample is one of the great majority which are representative. So although the inference is fallible, we are rationally justified in generalizing from our sample and concluding that the whole population resembles it.

The whole spirit of English-speaking philosophy is now much closer to Williams's outlook than it was: his work has helped to bring this about.

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KEITH CAMPBELL

Wittgenstein, Ludwig

Ludwig Josef Johann Wittgenstein was born in Vienna in 1889 and died in Cambridge in

1951, where he had earlier studied with Bertrand Russell and where he taught philosophy in the '30s and '40s.

There are two features of Wittgenstein's philosophy that could be taken to indicate the presence of a metaphysic, or of metaphysical theories, in his thinking. The first of these are what might be termed his constructive endeavours to outline our picture of the world in general and to give an account of the indispensable elements of the logic of our language, and hence of the 'scaffolding' of the world. The second feature is the presence of a few broad distinctions which are explicitly drawn between ways of talking about or conceiving of the world, and of a fair number of key notions which seem to imply the possibility of drawing such distinctions.

Tractatus Logico-Philosophicus. The first feature may be seen to be exemplified by what has often been called the 'ontology' of the *Tractatus*. According to this theory, the world is the totality of facts, not of things; a fact is the existence of a state of affairs; a state of affairs is a combination of objects; and objects are simple. These, to be sure, are the rudiments of an ontology, and Wittgenstein continues to say a good deal more about the various notions involved. There is one detail, however, about which he is supremely silent, and that is the nature of the objects which, after all, appear to have to form the basis of the whole structure. This silence has given rise to sustained speculation on the part of Wittgenstein's readers and exegetes and the most diverse types of candidates for the role of Tractarian object have been proposed. Thus they have, e.g., been claimed to be atoms of physical or conceptual reality, universals, or sense-data. None of these proposals has met with more than partial acclaim. And if one pays attention to the second feature mentioned above, it can easily be seen why none of those proposals has been found compelling. For, while it may be possible to reconcile Wittgenstein's narrowly 'ontological' statements with virtually all the readings which have been put forward so far, all these readings are incompatible with what is implied by one of his central distinctions, viz. the distinction between what can be said and what can be shown. In a well-known letter to Bertrand Russell of 19 September 1919, Wittgenstein says that this distinction concerns the main problem of philosophy, and in the *Tractatus* it is used and mentioned in the main body of the book and clearly alluded to in its short preface. If one applies this distinction to what is said and what is *not* said about objects in the *Tractatus*, it becomes quite clear that the nature or essence of objects simply is not a topic for meaningful talk. What can be *shown* or *become manifest* in connection with objects is their privileged relation to names, but Tractarian names themselves are subject to the saying-showing distinction and turn out to be intelligible only if they are understood as elements of propositions.

This distinction between what can be shown and what can be said is much more difficult to grasp and apply than it may seem. There is a certain danger of regarding showing as a kind of surrogate saying, as the next best thing to saying something if saying it is for some reason precluded. That which can be shown need not be the same as that which cannot be said: if the nature of objects is a non-topic, then you must not suppose that there is something which, although words fail you, can or may be revealed to you or any other (type of) being in a different way conveniently labelled as 'showing'. The metaphysician's desire to grasp and give a reasoned account of the nature of objects is, according to Wittgenstein, bound to be frustrated. The only correct answer to the metaphysician would be "to demonstrate to him that he had failed to give a meaning to certain signs in his propositions" (*Tractatus Logico-Philosophicus* (TLP) 6.53) but that, Wittgenstein adds, would not be satisfying to the metaphysician. What the latter's attempts – which are, to use a later phrase, a kind of "running up against the limits of language" (Waismann 1979, p. 68) – may show is what he values, but value is for Wittgenstein an example of what cannot be given an account of.

The saying-showing distinction is connected with the sense-nonsense (senselessness) distinction. In the *Tractatus* Wittgenstein identifies a set of propositions which are nonsense of an especially relevant kind. This set com-

prises propositions employing 'formal concepts' (e.g. 'object', 'complex', 'fact', 'function', 'number' (TLP 4.1272) and expressions intended to express identity); using a more recent terminology, one might call them propositions serving to describe our conceptual framework and thus the basic structure of our ways of looking at the world. Wittgenstein, however, regards such propositions as 'pseudo-propositions' and denies that they could be used to give information of the desired kind. Their use may show something – and the *Tractatus*, which, after all, does employ many propositions judged nonsensical by its author, is intended to be an example of this – and what this use may show is, according to Wittgenstein, that the metaphysical enterprise of trying to give an account of, or describe, the scaffolding of the world is doomed to result in nonsensical utterances. In short, the *Tractatus*, although perhaps not strictly anti-metaphysical (for *trying* to do metaphysics *may* show something of value), is meant to make the reader see that a positive metaphysical message is not to be hoped for.

Later Philosophy. In his writings and lectures of the 1930s Wittgenstein stresses that metaphysical statements are the result of our (misguided) "craving for generality" (cf. *The Blue Book* 1958, pp. 17 ff.); they may even be a form of scientism, trying to apply the methods and notions of the natural sciences to questions which it would be no help to answer in such a straightforward manner, because help could only come from patient attempts at clarifying or describing our use of the expressions concerned. In the *Investigations* this idea is epitomized in remarks like "*Essence* is expressed by grammar" (I.§371), "A whole cloud of philosophy condensed into a drop of grammar" (II.xi, 222). Their meaning, however, has often been misunderstood in that these and analogous remarks have been taken to indicate that Wittgenstein believes that our use of words in more or less ordinary language-games is based on foundations, probably a system of rules called 'grammar' which somehow embodies the essence of our concepts and thus forms a conceptual framework underlying all possible ways of talking about and representing the world. In a similar vein it has been suggested that what Wittgenstein calls 'grammatical statements' can, analogously to Kant's synthetic *a priori* propositions, reveal parts of that framework. For this way of reading Wittgenstein there is very little textual evidence. The very notion of a language-game, his practice of insisting on the individual case and on the force of well-chosen examples, and his way of representing our craving for generality as a kind of disease of our understanding all tell against a metaphysical interpretation of his notion of grammar and his remarks about rules and rule-following, which are closely connected with his use of that notion. Moreover, there is a certain parallel between his grammatical propositions (which are commonplaces like "Every rod has a length" or "An order orders its own execution") and his earlier pseudo-propositions. Both may seem to exhibit a kind of profound necessity, but that is bound up with their saying nothing in the *Tractatus* sense of 'saying'. (In contrast to pseudo-propositions, however, grammatical propositions do have a very specific use in certain language-games.) Wittgenstein's later practice clearly shows that he regards a philosopher who holds a metaphysical thesis (e.g. Platonism in the philosophy of mathematics) as a kind of patient who by way of being shown numerous examples of how language does work or might work should learn to live without this thesis and without embracing another, equally metaphysical one in its stead.

In his very last writings Wittgenstein develops his notion of a world-picture (cf. *On Certainty*, 1974, §§93–9). Sentences descriptive of such a world-picture are like the rules of a game – there is no point in doubting them as long as *this* is the game we play (and do not wish to change it); there is no way of denying these sentences without contradicting what everyone regards as obvious; they are connected with some of our most common concepts and indicate important features of their use. Because of the generality, the immunity from error, and the regulative force ascribed to a world-picture this notion might be regarded as a metaphysical one. But as a Wittgensteinian world-picture is more

like a rag-bag than an orderly structure, as it is neither the object of a special kind of knowledge nor immutable, the corresponding notion could be called a metaphysical one only by courtesy.

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JOACHIM SCHULTE

Wolff, Christian

Christian Wolff (1679–1754) is generally considered to be the leading philosophical personality of the German Enlightenment. Born in Breslau, Wolff came when at the Magdalenen-Gymnasium under the influence of both main philosophical currents of his time, namely Cartesianism and Scholasticism. He studied theology, mathematics, and physics in Jena, from whence he moved to Leipzig as professor of mathematics. In 1704 he sent his thesis *De algorithmo infinitesimali differentiali* to Leibniz, who thereupon helped him to become professor of mathematics in Halle in 1706. Right from the start, Wolff, who gave his lectures in German, was very successful as a professor. In 1723, as a consequence of the uncompromising pietistic opposition to his rationalism and his assertions on the morals of the Chinese which were regarded as dangerous for religion, Wolff was expelled from Halle by royal decree and moved as mathematics and philosophy professor to Marburg. At the peak of his popularity in 1740, Wolff enjoyed a triumphal comeback to Halle following his appointment there by the new king, Frederick II. He was created a member of the academies of science in London, Berlin, Paris, and St. Petersburg. Wolff's numerous followers spread his philosophy throughout Europe.

Wolff was enormously prolific as a philosopher and he twice published his entire philosophical system, which can surely be considered the most complete and coherent system of the 18th century. One version was written in German in popular form; the other was written in Latin for scholars. Wolff attempts to harmonize the methodological achievements of Cartesianism and science, on the one hand, with the Catholic (Thomas Aquinas and Suárez) and Lutheran scholastic traditions (*Deutscharistotelismus*) on the other. This can be seen especially in his metaphysics, where he attributes a basic function to a renewed ontology.

With his *Philosophia prima sive Ontologia, methodo scientifica pertractata* (1730) – the first publication in which the word 'Ontologia' appears in the title – Wolff tries to realize Leibniz's idea of an *emendatio philosophiae primae*. This *philosophia prima*, which had been brought into disrepute by the Scholastics and consequently despised by the Cartesians, must not be dispensed with, Wolff argued, but rather improved. First philosophy should be on the one hand *scientia fundamentalis*, treating of all the principles of human knowledge (a conception that was accepted until the time of Kant). On the other hand Wolff makes a distinction between an *ontologia naturalis* and an *ontologia artificialis*. The former relates to those ontological concepts (*notiones generales*) which are used unreflectedly in human speech (cause, purpose, necessary, contingent, possible, impossible, and so on). The latter consists of the 'scientific' (i.e. methodical) application of ontological concepts achieved by natural intellect. The Scholastics had dealt only with the domain of natural ontology, i.e. with the clear but indistinct terms which are derived from common sense (*naturali mentis vi*). These are originally given in human speech, and are therefore already present in it; they consequently represent the essential beginning of philosophy. But this *ontologia naturalis* has to be put on a scientific footing via the scientific method, which Wolff conceives as a means of arriving at the clear and distinct concepts of the *ontologia artificialis*.

Wolff's rationalistic attitude can be recognized in his assumption that ontological terms are present already in human speech; the

order of being and knowledge harmonize. Ontological terms express the order and regularity of things, as far as they are intelligible through the highest principles of human reason (principle of identity and sufficient reason). Ontological terms thus express logical relations between the internal attributes of things without regard to the latter's existence or non-existence. Wolff's ontology does not relate to an Aristotelian existence (ὄν ἢ ὄν) but to things (*entia*, *Dinge*). Wolff refers to things as Kant refers to objects (*Gegenstände*), and in part for this reason some authors (for instance, H. Pichler) have emphasized the aspect of a 'theory of objects' in Wolff's ontology. Thus, a central ontological term, the most important attribute of the *entia*, is 'essence' (*essentia*, *Wesen*), which means nothing other than the inner possibility of things (the possibility that they exist). Possibility is defined by Wolff as freedom from contradiction in the relevant concept; thus it is defined in a logical sense.

With Wolff, there enters a new conception of metaphysics which joins together the scholastic and Cartesian traditions. This metaphysics means *scientia entis*, *mundi in genere atque spirituum*, it includes ontology, general cosmology, psychology, and natural theology. On the one hand, Wolff rejects the Aristotelian view of metaphysics as being a unity of ontology and natural theology. On the other hand, his systematic classification of metaphysics reveals his distinction between *metaphysica generalis*, dealing with *ens qua ens*, and *metaphysica specialis*, dealing with substance and its attributes.

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SONIA CARBONCINI

Woodger, Joseph Henry

Joseph Henry Woodger, born 2 May 1894, read zoology at University College, London, graduating in 1911. After World War I he lectured on zoology and comparative anatomy at the college. In 1922 he was appointed to a readership in the department of biology at the Middlesex Hospital Medical School. He was made professor of biology, University of London, in 1949. In 1959 he retired. He died on 8 March 1981.

In his early 20s he developed an interest in the philosophy of science, which served him well when as a reader responsible for teaching biology and some courses for medical students he conceived the idea of applying the principles of scientific method to biological theories with a view to enhancing the clarity and precision of biological statements. He acquitted himself of the first stage of his project by publishing *Biological Principles*, for which the university awarded him the degree of D.Sc. In order to accomplish the next stage, which involved identification and analysis of presuppositions implicit in biological theories, Woodger thought he had to master modern symbolic logic and to acquaint himself with the latest developments in metalogic. This he did with remarkable thoroughness, as is witnessed by *The Axiomatic Method in Biology*. The part of biological theory symbolized and axiomatized in this work rests on the following presuppositions:

1. a theory of objects as ordered in time (theory T),
2. a theory of part-whole relations (theory P),
3. logic as developed and presented by A. N. Whitehead and Bertrand Russell in *Principia Mathematica*.

The axiomatization of T may have been inspired by A. A. Robb's earlier work. A. N. Whitehead's theory of 'extensive expansion' may have influenced P in a way. However, in choosing axioms for T and P Woodger had the benefit of Alfred Tarski's advice; Tarski included his own axiomatization of the two theories in *Appendix E* to the monograph.

In *The Technique of Theory Construction*, Woodger addresses himself to the metalogical problem of generalizing non-logical subject matter concepts in theories of lesser

generality so that what remains of those theories is in fact logic, which determines the relation of premisses to consequences in a scientific theory. By formalization of scientific theories he means

1. elucidating undefined terms,
2. establishing rules of statement construction,
3. establishing rules of statement transformation.

His discussion of the way a scientific theory should be constructed is related to a *formalized*, axiomatized, and symbolized specimen of a biological theory based on the concept of *cell*.

The theories of *P* and *T*, in union with logic, can be treated as the nucleus of a general theory of objects (ontology). It can be extended by subjoining to it further theories, descriptive of objects but more general than biology, and should, therefore, be of interest not only to logicians but also, and perhaps in the first place, to philosophers. It may be worth noting that Woodger distinguished between physical objects and non-physical ones, such as views, sounds, smells, tastes, and feels. Of his numerous contributions to the semantics of natural language the analysis of proper names deserves attention for its originality.

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CZESŁAW LEJEWSKI

Worlds, Possible Worlds

The idea of a plurality of real worlds is much older than the idea of a plurality of possible worlds. The first originated with the ancient Greek philosophers; the latter was brought into prominence by Leibniz in the 17th century. Though the connection between the two is not often discussed, it is likely that the ancient tradition, redefined and renewed as part of the 17th-century scientific revolution, did influence Leibniz and the broader history of possible worlds.

The tradition of many real worlds is almost coincident with the birth of Western science in ancient Greece. The Greek atomists Leucippus (fl. *c.* 459 BC) and Democritus and their disciple Epicurus posed the interesting question whether the visible world (κόσμος) constituted all of existence, or whether there existed innumerable such worlds (ἄπειροι κόσμοι) each with its own stars and planets. It was their atomism that inspired this question and that provided an unambiguous answer: because they believed our world came into being through the chance coalescence of moving atoms, and because these atoms were infinite in number and had not been used up in our own finite world, the atomists believed in an infinite number of worlds similar (though not identical) to our own, each containing its own stars and planets. Though these worlds were by the definition of the term 'cosmos' invisible, the Greek atomists believed they actually existed.

Aside from this atomist belief, another variation of the plurality of worlds doctrine originated with the Greeks: the doctrine of successive, rather than coexistent, worlds.

Aristotle opposed the atomist claim and strongly asserted his belief in a single cosmos, now in the form of a hierarchical geocentric system of concentric spheres. It was this conception that served as the standard cosmology for some 2000 years. In commentaries on Aristotle's *De caelo* as well as in theological treatises, the medieval scholastics, among them Thomas Aquinas, John Buridan, and William Ockham, argued in defence of the idea of a plurality of worlds. After the condemnation in 1277 of those Aristotelian ideas that infringed on God's power, most scholastics concluded that God could have created such worlds if he wished, but that they did not exist in actuality. This is an early example of how the concept of real worlds

gave rise to the discussion of possible worlds.

With the Copernican revolution, the terms of the plurality of worlds debate changed altogether. Copernicus (1473–1543) set the Earth in motion with the rest of the planets around the sun. The term 'world' (*mundus*) now came to mean an Earth-like planet. With the advent of the telescope, Galileo Galilei, Johannes Kepler (1571–1630), John Wilkins (1614–72), Bernard le Bovier de Fontenelle (1657–1757), Christiaan Huygens (1629–95), and other natural philosophers now debated just how Earth-like the other planets might be, and concluded that life was possible on these other worlds.

The vortex cosmology set forth by René Descartes in the *Principia philosophiae* (1644) carried the debate beyond the solar system; it argued that the laws of motion in a universe filled with matter necessitated the existence of many vortices, each vortex centred on a star. This was the first physical basis for the assertion of a plurality of solar systems (though Giordano Bruno had sixty years earlier argued for this on metaphysical grounds). By the end of the century, Sir Isaac Newton had proved that the vortex cosmology was mathematically impossible. He replaced it with a mechanical universe greatly influenced by the atomist world view, with its atoms in motion in void space, but now subject to the universal mathematical laws of gravitation that he enunciated in the *Principia* (1687). In such a universe, a plurality of planets and solar systems was possible by analogy with our own world, but not assured. Partly in response to criticisms that the Newtonian system did away with the need for God (an argument in which Leibniz became involved), Newton and his followers incorporated the idea of a plurality of real worlds into the Newtonian system via natural theology, rather than physical principles. In his *Opticks* (1706), Newton even suggested that God might be able to "vary the laws of nature, and make worlds of several sorts in several parts of the universe".

In his *Theodicee* (1710), Leibniz argued that God, in creating our world, selected it from many possible worlds. These do not now exist, but they might have, had God so desired (note the connection to the medieval belief). He believed that ours was the best of all possible worlds. In an Earth seemingly full of evil, Leibniz believed that these evils would be balanced by good in a wider world that might be filled with life.

In a beautiful example of historical symmetry, the last few decades have seen a conjoining of the two traditions of real and possible worlds in the form of the cosmological anthropic principle. This principle, which mixes science and philosophy, notes that life in the universe would be impossible were the nature of the universe (i.e. its physical constants, dimensions, etc.) only slightly different. Why should this be so? One of the answers is that our universe is only one of many possible universes. Barrow and Tipler (1986) have exhaustively examined the implications of this anthropic principle for many fields of study, including cosmology, the many-worlds interpretation of quantum mechanics, and biochemistry as it applies to life in the universe.

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STEVEN J. DICK

Würzburg School

Oswald Külpe (1862–1915) is called by G. Humphrey (1951) "the source of the power" of the Würzburg School. Though he was not the founder of the movement, it was he who actively kept it alive. When he left Würzburg, and began to interest himself in other things, the movement died. Külpe studied with Wilhelm Wundt (1832–1920) in Leipzig and with Georg Elias Müller (1850–1934) in Göttingen. He obtained his Ph.D. in 1887 with a thesis *Zur Theorie der sinnlichen Gefühle*, and in 1888 wrote his habilitation

thesis, *Die Lehre vom Willen in der neueren Philosophie*. He was called to Würzburg in 1894 as professor of philosophy and aesthetics, and in 1896 he founded the Psychological Institute of the University of Würzburg. He taught there until 1909, and thereafter in Bonn and Munich.

Külpe's two early works indicate on the one hand a Wundtian background with which he later broke, and on the other hand an interest in the psychology of the thought processes, which later became the central issue of the Würzburg School. Experimental psychology first had to develop an adequate theory of sensations and feelings. Only later, as he put it in his *Lectures on Psychology* (1922), could it "deal with airy thoughts, which at first escape our notice". The challenge of a psychology of thinking attracted some outstanding philosophers, psychologists, and students to Külpe and Würzburg, who together formed the Würzburg School. They included Karl Marbe (1869–1953), Külpe's successor in 1909; Karl Bühler, who first studied under Carl Stumpf in Berlin, was influenced by Edmund Husserl, and who later followed Külpe to Bonn and Munich; August Messer (1867–1937); Narziß Ach (1871–1946), and Henry Jackson Watt (1879–1925). For a short while, Kurt Koffka (1886–1941), who had studied under Stumpf in Berlin, worked as assistant to both Külpe and Marbe in Würzburg. Otto Selz is sometimes counted as a member of the Würzburg School, though in fact he worked with Külpe only later at Bonn.

General Characteristics. The novelty of the Würzburg School or 'Külpe School' consisted in its rejection of the traditional view, accepted from Aristotle to Wundt and Franz Brentano, that higher mental processes are not directly accessible by experiment. Thus their work constituted the first systematical experimental investigation into the psychology of thinking, an investigation based on the results of introspection. (Parallel work was done by a former student of Wundt, Edward Bradford Titchener (1867–1927).)

Conscious thoughts were first of all experienced as not containing images or presentations; they are 'non-intuitive'. Again against the standard view from Aristotle to Brentano that thinking states necessarily imply presentations as foundational parts, the higher thought processes were affirmed by the Würzburger to be imageless and without content or such as to exclude acts of sensation, feeling, and will. They are in this sense 'purely mental'.

Examples of such thought processes are associations, judgements, acts of doubt and expectation, an experience of sureness or of being on the right track. All of these were characterized as observable yet neutral "states or attitudes of consciousness" ("*Bewusstseinslagen*", "*Bewusstseinszustände*"), states which "are of very diverse character, and have only this in common, that they represent psychological facts which are not capable of further exact analysis" (J. Orth, 1847–1923, in his *Gefühl und Bewusstseinslage*, Berlin, 1903). The method of experimental fixation of such psychical states consists in answering questions by means of descriptions or reports ('protocols'), not in seeking interpretations of what is happening psychically. The aim of the method is the description of the genesis and general course of thinking processes and of the 'mental set' (*Einstellung*) which serves as the background to a given process of thinking.

The *Bewusstseinslagen*. The Würzburg School had its beginning with a paper "On the qualitative investigation of association", published in the *Zeitschrift für Psychologie* in 1901 by A. Mayer and J. Orth. This paper represented an experimental attempt to show the psychological nature of association by means of a controlled procedure of introspection. The subject was asked to report his free associations in response to a stimulus word given by an observer.

> The subjects frequently reported that they experienced certain events of consciousness which they were quite clearly unable to designate either as definite images ('presentations', *Vorstellungen*) or as volitions.

All these events, whether accompanied by feelings or not, are dubbed states or sets of consciousness (*Bewusstseinslagen*). In his *Gefühl und Bewusstseinslage*, Orth describes the latter as a cross-section of all consciousness. Karl Marbe, in his *Experimentell-psy-*

chologische Untersuchungen über das Urteil (Leipzig 1901), confirms the existence of the *Bewusstseinslagen*, and in his "Experimentell-psychologische Untersuchungen über das Denken" (*Archiv für die gesamte Psychologie*, 1906), August Messer proposes replacing the term with the word 'thoughts' or '*Gedanken*', taken to include both conscious and unconscious imageless mental elements.

The Theory of *Gedanken*. Karl Bühler attempted to describe the thought processes of his subjects by analysing their reports of what they had experienced during processes of solving problems. One sentence occurring very often in these reports was: "I found the solution, but I did not imagine, and I did not speak". Moreover, Bühler found that presentations and images emerge only fragmentarily, sporadically, and accidentally in such thought-experiences (*Denkerlebnisse*), and he inferred that such phenomena cannot be the carriers of the close-fitting and continuous thought content which leads to problem-solution. (See his paper "Über Gedanken", *Archiv für die gesamte Psychologie*, 1907.) Not presentations or images, then, are the carriers of thinking, but thoughts ('*Gedanken*'), which are "the ultimate units of our thinking experiences".

Bühler distinguished three types of thoughts: 'consciousness of a rule', 'consciousness of a relation', and 'intention', each corresponding to a different type of mental process. Each such mental element occupies a certain position in the order of our thinking experience. Contents of thinking experiences are not primarily defined by their palpable attributes, but by relations to other elements, to a position (*Platz*) in this wider conscious order. The nature of each thought-content is a function of its position ('*Platzbestimmtheit*') in this order.

Determining Tendency; Task. Narziß Ach, in his book *Über die Willenstätigkeit und das Denken* (Göttingen 1905) affirmed the existence of what he called 'determining tendencies' in thinking processes. These are imageless object-directed thoughts similar to the classical 'psychical determination' or 'motivation' and to what Watt in his "Experimentelle Beiträge zu einer Theorie des Denkens" (*Archiv für die gesamte Psychologie*, 1905), called 'task' ('*Aufgabe*'). A task is a directive, e.g. for naming and classifying superordinates for subordinates and parts for wholes. The conscious task associated with a given problem eventually brings about an unconscious mental set (*Einstellung*), so that the thinking process can thereafter occur without the thinker being aware of what determines the course of his thoughts.

Külpe in his review of Ach (*Göttingische gelehrte Anzeigen*, 1907) argued that a complete account of mental states can be given only by means of a distinction between 'acts' or 'functions' of consciousness on the one hand, and 'contents' on the other – a remark which brings to mind the phenomenological origins of the theory of thought processes.

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ELISABETH AND WILHELM BAUMGARTNER

Z

Zabarella, Jacopo

Jacopo Zabarella (1533–89), one of the greatest Aristotelian commentators of the 16th century, was from 1564 until his death professor in the University of Padua. In his day he was appreciated primarily as a natural philosopher and in that capacity he wrote, apart from commentaries on Aristotle's *Physica*, *De anima* and *De generatione et corruptione*, many treatises on physical and psychological subjects collected in *De rebus naturalibus* (Venice 1590). His main contribution to philosophy lies, however, in the field of logic. Ever since the end of the 13th century the Aristotelians of the School of Padua had been engaged in the development

of a logic of invention to complete Aristotle's theory of proof and it is in Zabarella's writings on logic, based on Aristotle's *Organon* and Averroes's commentaries, that this tradition reached its culmination.

Zabarella subscribes to Aristotle's theory of science as the demonstrative knowledge of things through their causes. But he rejects the idea that these causes are self-evident and able to be known by mere sense-perception. While all science starts with sensory knowledge of effects, natural phenomena can be understood only in terms of preceding causes, most of which are imperceptible. Thus it seems impossible to acquire scientific knowledge of effects in so far as the knowledge of causes, if knowable at all, presupposes that of effects. The scientist, in other words, is confronted with the problem of how to demonstrate natural phenomena without either invoking *a priori* principles as causes or invalidating his proofs by basing his derivations on circular arguments.

Zabarella's solution to this problem, as formulated in *De methodis* and *De regressu*, is based on four distinctions:

1. induction versus deduction,
2. the order of nature versus the cognitive order,
3. vague, that is, hypothetical knowledge of the existence of things versus distinct, that is, absolutely certain knowledge of their nature,

and

4. the method of investigation versus the order of instruction.

As an Aristotelian, Zabarella understands by science absolutely certain knowledge concerning causal relationships. It is acquired by the transition, effected through a syllogism, from something known to something unknown. Accordingly, in Zabarella's view all scientific methods of investigation are patterned upon the syllogism. The scientist has two methods at his disposal. He can either derive a cause from its effect by an *a posteriori* proof or induction, or he can deduce an effect from its cause by an *a priori* proof. The first procedure, called resolution, is based on sense-perception and, in going from effect to cause, follows the cognitive order instead of the order of nature. This implies that it informs us only about the existence of a cause and thus supplies no more than vague causal knowledge. The second procedure, however, called composition, starts from a rationally known cause and thus leads, following the order of nature, to distinct, causal knowledge of an effect. It informs us, in other words, not only about the nature of a cause but also shows the causal relation involved. Resolution is thus subservient to composition, and leads to science only in combination therewith. This implies that physics, which starts from the senses, always requires a combination of both procedures. However, as resolution ends in a hypothesis, while composition must start from unquestionable truths, the one cannot directly pass into the other but needs to be followed first by a mental consideration through which the vaguely known cause is analysed and distinctly conceived. To complete the investigation, the perceived fact can then be deduced from that cause.

This combination of resolution and composition mediated by a mental consideration is known as a *regressus*. But the acquisition of perfect science requires in addition an 'order' or 'instrument' to dispose the parts of a discipline in such a manner that it can be learned in the easiest possible way. As opposed to method, an order has no force of inference and is independent of the order of nature. Corresponding to the distinction between theoretical and applied sciences there are two kinds of order. While the theoretical sciences follow the compositive order, going from the first principles of things to their proximate causes, applied sciences require a resolutive order that goes from an end to be achieved to the first principles of its realization. Thus a master builder who wants to explain the rationale of his craft, reasons backwards from the idea of a house to be built through the antecedent steps that are necessary to realize his project. First he explains the form and material of its roof, then the erection of the walls, next the laying of its foundations, followed, finally, by an explanation of the preparation of the building-site.

Thus Zabarella transformed the Aristotelian notion of experience into the modern concept of induction and in clarifying the relationship between logic and metaphysics he gave the Paduan theory of method its definitive form.

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JAN PRINS

Zeno of Citium

Zeno of Citium (*c.* 332–*c.* 265 BC) founded the Stoic School, which survived until 260 AD. He came to Athens in 311, where he studied with the Cynic philosopher Crates, with Stilpo and Diodorus Cronus (both of them masters of Megarian dialectic), as well as with Polemo (died 270 BC), then head of the Platonic Academy. Around 300 Zeno began lecturing on his own. The instruction was given in the 'colourful hall' (στοά ποικίλη) located in the market-place in Athens. It was this public porch that the school was named after.

Like other philosophers in the Hellenistic period, Zeno held that the task of philosophy was to provide a guideline for life and thus to contribute to human well-being (εὐδαιμονία) which the Stoics claimed consisted in the life of reason undisturbed by passions (πάθη). Unlike Pyrrho (*c.* 360–*c.* 270 BC), who advocated suspension (ἐποχή) of judgement as a means of acquiring tranquillity of mind, and unlike Epicurus, who thought that the world was a product of mindless chance (τύχη) and contained no cause for worry, Zeno was convinced that reality is structured by reason. Thus it can be shown to be the expression of some sort of objective plan (λόγος) and thus also man will fare well once he comes to understand this structure and live accordingly.

There is no doubt that Zeno was a materialist in the sense that he held that to be real is to be a three-dimensional solid capable of acting or being acted upon and that reality so-called (οὐσία) must be describable in terms of corporeal events. Also he is agreed to have been an adherent of some kind of monism in that he held that there is but one reality only and that reason (λόγος), in virtue of being able to penetrate matter (ὕλη), is coextensive with the sum of existence. In viewing both matter and structure as features of reality rather than as distinct constituents, the Stoics seem to have anticipated the view attributed to Spinoza regarding the ontological status of the so-called attributes. There is, however, some doubt as to whether Zeno committed himself to recognizing some further realm of reality and thus became liable to the charge of Platonism after all. This holds even more of Chrysippus, who elaborated the Stoic system and defended it against the attacks of the Academy by holding that there are meanings (λεκτά) comparable in some ways to Fregean senses.

Philosophy according to Stoic doctrine divides into three disciplines:

1. logic,
2. physics,
and
3. ethics.

The domain of logic includes theory of knowledge, rhetoric, and dialectics. The latter is divided in turn into grammar and theory of meaning, the second of these including formal logic.

In their theory of knowledge the Stoics were empiricists, maintaining that

> all thought proceeds from sense-perception [αἴσθησις] . . . and that generally there is nothing to be found in thought [ἐπίνοια, reflection] which one does not already possess from sensual encounter (*Stoicorum Veterum Fragmenta* = *SVF* 2.88).

It is by no means clear, though, what precisely these perceptions are about or what exactly they consist in. In any case, the Stoics held that the affection of the senses leads to an imprint (τύπωσις) in the soul and furnishes

a presentation (φαντασία) of the thing perceived. Yet it is only in virtue of an active assent (συγκατάφασις) on our part that a grasp (κατάληψις) of the thing presented is accomplished – which in turn yields cognition of the object. Zeno held that the criterion to employ in order to find out whether or not a presentation is true is its cognitive (*cataleptic*) character. That is to say, the presentation must arise from something that is and must be formed into the soul according to what is and be such that it could not arise from something that is not (*SVF* 1.65; cf. 1.59).

As far as logic proper is concerned, Zeno himself apparently did not contribute anything to the Stoic logic that has been recognized ever since the work of Jan Łukasiewicz (1878–1956) in 1935 (cf. *Erkenntnis*, Volume 5). It was Chrysippus who, defending the Stoic positions against the logic-chopping attacks of Arcesilaus (*c.* 315–241/40 BC), came to recognize that he and his fellow philosophers were in need of a theory of proof the rules of which could be used for the task of elaborating argument forms. (Apparently the Stoics were able to draw from Megaric logicians who had developed a propositional logic, the extent of which, however, remains to be uncovered.) It was Chrysippus, too, who following Zeno and Cleanthes (331–231 BC) elaborated the Stoic theory of meaning and thus came to distinguish between senses of terms and predicates (i.e. incomplete λεκτά) on the one hand and senses of sentences (i.e. complete λεκτά, or ἀξιώματα) on the other.

In the field of physics or philosophy of nature, Zeno affirmed first of all that everything that is must be capable of acting or being acted upon. The Stoics subsequently distinguished between what they called the active and the passive principles (ἀρχαί), that is between reason (λόγος) and matter (ὕλη), respectively. Unlike Aristotle, on whose terminology they seem to have relied, the Stoics held that 'reason' and 'matter' denote the same thing, οὐσία that is, but under different aspects. Furthermore, they distinguished between principles and elements (στοιχεῖα), claiming, however, that in reality there is no such thing as matter without quality but only body formed in a certain way.

Among the so-called elements, fire was on occasion considered the dominant force which somehow shapes things (*SVF* 1.171), lending its warm breath (πνεῦμα) which penetrates all things and holds them together in virtue of its tension (τόνος). It was the doctrine of the infinite divisibility of matter which was to account for the claim that the universe or nature as a whole was structured by divine providence and causally determined. This was a point difficult to understand. In particular it raised the problem of how freedom of will could be preserved within such a system. From all we know Zeno and his followers tried to solve this problem by saying that man, even though he cannot choose the circumstances in which action will be called for, is free in the sense of being capable of giving or withholding assent (συγκατάθεσις) and thus determining the moral quality of his response (*SVF* 1.61).

Zeno claimed that any action results from having a presentation (φαντασία) which tends to issue in an impulse (ὁρμή) to accomplish whatever has been presented as to be done. However, for the action to be actually carried out what is needed is an assent. In the case of wrong actions the assent given is determined by wrong and unhealthy conceptions of the object to be pursued, conceptions liable to produce a passion (πάθος). Defining this passion as overriding impulse (*SVF* 1.205), Zeno held that it is brought about by such wrong judgements (*SVF* 1.208). Chrysippus apparently argued to the effect that passions are themselves judgements in their own right (*SVF* 3.456). This in turn means that the emotional state of man can, according to the Stoics, be controlled by the mind or even is a function of the state of mind. Thus it is easy to understand that acquiring virtue for the Stoics was, very much in keeping with the Socratic ideal, tantamount to mastering passions and even getting rid of them altogether (ἀπάθεια). Virtue in turn was considered to be the sole good (ἀγαθόν) and hence held to complete well-being (εὐδαιμονία).

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